SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XLI.—No. 13. [NEW SERIES.] NEW YORK, SEPTEMBER 27, 1879. [$3.20 per Annum. [POSTAGE PREPAID.]

A WONDERFUL CLOCK.

A short time since we gave a brief description of a clock made by Mr. Felix Meier, of Detroit, Mich We now present our readers an engraving of this curious piece of mechanism, which is said to eclipse all former achievements in this direction, without excepting even the Strasbourg, which for so many years has been regarded as the great clock of the world.

Mr. Meier's clock is the result of nearly ten years of patient labor and the expenditure of $7,000 in cash. The clock is eighteen feet in height, eight feet wide, by five feet deep, and weighs 4,000 lbs. It is of handsome proportions; the framework is entirely of black walnut, elegantly carved. Above the main body of the clock is a marble dome, upon which Washington sits in his chair of state, protected by a canopy, which is surmounted by a gilded statue of Columbia; on either side of Washington is a colored servant in livery guarding the doors, which open between the pillars that support the canopy; on the four corners of the main body of the clock are black walnut niches containing human figures, emblematic of the march of life; the two lower ones are supported by two female figures with flaming torches; one of them contains the figure of an infant, the second the figure of a youth, the third of a man in middle life, the fourth of an aged graybeard, and still another, directly over the center, contains a grinning skeleton representing Father Time. All of these figures have bells and hammers in their hands. The infant's bell is small and sweet toned; the youth's bell larger and harsher; the bell of manhood strong and resonant; that of old age diminishing in strength, and the bell of the skeleton deep and mournful.

The astronomical and mathematical calculation, if kept up, would show the correct movement of the planets for 200 years, leap years included.

The clock shows the time at Detroit in hours, minutes, and seconds; the difference in time at New York, Washington, San Francisco, Melbourne, Pekin, Cairo, Constantinople, St. Petersburg, Vienna, London, Berlin, and Paris. The day of the week, calendar day of the month, month of the year, and seasons of the year. The signs of the zodiac, the revolutions of the earth on its own axis and also around the sun. The revolutions of the moon around the earth, and with it around the sun; also the moon's changes from the quarter to the half, three-quarters and full. It also shows the correct movement of the planets around the sun.

There is a movement in this clock which cannot regularly be repeated more than once in eighty-four years.

The inventor has a crank attached to the clock, by means of which he can hasten the working of the machinery in order to show its movements to the public; by turning continuously twelve hours a day for sixteen days and eight hours, a perfect revolution of the planet Uranus around the sun would be made.

At the end of every quarter hour the infant in his carved niche strikes with a tiny hammer upon the bell which he holds in his hand. At the end of each half hour the youth strikes, at the end of three quarters of an hour the man, and at the end of each hour the graybeard. Death then follows with a measured stroke to toll the hour, and at the same moment a carved cupid projects from either side, with wings to indicate that time flies. At the same time a large music box, manufactured at Geneva expressly for this clock, begins to play, and a surprising scene is enacted upon the platform beneath the canopy: Washington slowly rises from the chair to his feet, extending his right hand, presenting the Declaration of Independence. The door on the left is opened by the servant, admitting all the Presidents from Washington's time, including President Hayes. Each President is dressed in the costume of his time. The likenesses are very good. Passing in file before Washington, they face, and raise their hands as they approach him, and, walking naturally across the platform, disappear through the opposite door, which is promptly closed behind them by the second servant. Washington retires into his chair, and all is quiet save the measured tick of the huge pendulum and the ringing of the quarter hours, until another hour has passed.

MEIER'S NATIONAL AND ASTRONOMICAL CLOCK

Traction Engines on Common Roads.

At a recent meeting of the Institute of Mechanical Engineers, Mr. R. E. B. Crompton, of London, read a valuable paper, showing the results and economies of traction engines, as used upon the common roads in India, derived from several years' experience. His general conclusions are:

1. That on the level roads of India traction engines can be relied on to work a service of trains with great regularity and at a fair speed; and that goods can be carried at four miles an hour, and passengers at eight miles an hour. At these speeds, the cost of a train containing 15 tons of goods, or about 7 tons of passengers, was about 2s. 2d. per train mile.

2. That the rubber tires, as used in such running, are of great service in reducing the cost of the ordinary engine repairs and in giving uniformity of adhesion, without in the least degree damaging the surface of the roads; that in return for these advantages the cost of maintaining these tires does not exceed 1½d. per train mile.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

VOL. XLI., No. 13. [NEW SERIES.] *Thirty-fifth Year.*

NEW YORK, SATURDAY, SEPTEMBER 27, 1879.

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Dovetail and Dovetail Tools. 7 figures. Dovetails (13 forms). Dovetail cutter. Dovetail machines. Dovetail marker. Dovetail saw.

II. TECHNOLOGY.—Ropiness in Beer. Its conditions, cause, and cure.

Flexible Negatives. By A. W. TURNER.

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IV. CHEMISTRY.—Journal of the Chemical Society. Abstracts of Papers.

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On the Fertilization of Yucca. By Professor THOS. MEHAN. A popular theory antagonized by observed facts.

XI. THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The President's Address. The results of recent researches into the nature and phenomena of living matter, etc.

TECHNICAL SCIENCE IN NEW ZEALAND.

The SCIENTIFIC AMERICAN has been asked to solicit the kind offices of American inventors, manufacturers, and other friends of industrial education, on behalf of a worthy institution in far away New Zealand.

To provide "all classes and denominations" of the New Zealand population with facilities for pursuing a regular and liberal course of education, Canterbury College has been established at Christchurch, the principal town of the province of Canterbury, and is now in good working condition. In connection with this college there has been founded a scientific museum, housed in a handsome stone building erected at a cost of upward of $100,000, and comprising a valuable collection of specimens of natural history, and type collections of minerals and fossils. An effort is being made to establish in this museum a department of technical science, for which contributions of models of machinery, implements, and the like, are now solicited. The reception of such contributions, and their shipment to New Zealand (freight charges to be paid there), will be undertaken by the publishers of this paper.

So much for the message committed to us. A word or two with respect to the reasons why the request should be cheerfully and abundantly met.

New Zealand is one of the most worthy and promising of the younger members of the Greater Britain made up of all the English speaking countries of the globe. As the youngest, too, among the rising nations allied to us by blood, and bound to us by rapidly strengthening commercial ties, New Zealand is in every way deserving of all the educational assistance we can give her; and it can be safely promised that her people will be duly grateful for anything we may do in this way.

There is a lower (possibly to some a more cogent) reason why this request should be granted: it will pay commercially. Already New Zealand is one of the most inviting of foreign markets for American manufactured products; and there is no way by which American manufacturers can place their machines, implements, and other wares more effectually before the New Zealanders than by having them thus favorably placed on perpetual exhibition at the chief center of intelligence in the colony.

It is not yet forty years since the first white settlers landed in New Zealand, and already the population numbers something like half a million of wide awake, active, and intelligent English people. The islands have an area of over 100,000 square miles; a trifle less than that of Great Britain and Ireland, and something more than twice that of the State of New York. About 12,000,000 acres are fit for agriculture; 50,000,000 acres are suitable for pasturage; 20,000,000 are forest lands. The climate is much like that of England, but more equable. There is more sunshine and a smaller range of temperature. The annual mean for the North Island is 57°, that of the South Island is 52°. The mean annual temperature of London and New York is 51°. The country is rich in minerals, and its resources are being developed rapidly. In 1876 the foreign commerce of New Zealand was equal to that of Norway. It was more than that of any of the South American states except Brazil; more than that of any African states except Egypt and Algeria; greater than that of Japan; and was exceeded in Asia only by China, Java, and the Straits Settlements. It was exceeded in Australasia only by Victoria and New South Wales. In 1875 its trade with the United States exceeded $10,000,000. In 1876 the colony had 600 miles of railway, and in 1878 something like 1,000 miles. In 1875 there were in operation over 3,000 miles of telegraph lines, with a mileage of telegraph wire exceeding 7,000 miles. These are the latest statistics at hand; and the rate of progress is such that they must be largely increased to bring them up to the probable figures required to indicate the present condition of the colony.

It is to a country possessing such notable capacities for commercial developments, and offering so many inducements for the cultivation of friendly relations, that the asked for models and specimens of machinery and industrial appliances are to go, to be placed on view, as already said, under the most favorable conditions possible.

In very many instances, doubtless, the most efficient as well as most economical representation to send will be a perfect machine or implement of regular make. The photographs of the museum rooms—which may be seen at this office by any one who is interested—show an abundance of space for the proper display of contributions; and as the museum is a place of popular resort not only for the people of Christchurch, but for all visitors to that capital, a more attractive mode of exhibiting matters suitable for the markets of the colony could not be devised. We sincerely trust that our energetic, generous, and far-seeing manufacturers will take the matter in hand earnestly, and that while Canterbury College is enriched by specimens of high educational value, the industries of the United States will have in them a full and honorable presentation before the students of the institution and the public at large.

It may properly be suggested here that contributors should affix to each specimen a special tablet bearing the inscription: "Presented to the Technological Collection of Canterbury College Museum, Christchurch, New Zealand, by, etc., etc.," giving the donor's name and post office address.

An Amendment of the New South Wales Patent Law.

The conditions of the patent law of New South Wales have been amended (June 19, 1879) so that exhibitors of unpatented inventions at any International Exhibition within the colony, or any other agricultural or industrial exhibition declared to be such by the governor with the advice of the executive council, shall not prejudice the right of the exhibitor, if he be the author or designer of the invention, to apply for letters of registration for such invention under the patents act. Neither will the publication of any description of the invention during the holding of the Exhibition, nor the user of the invention elsewhere without the privity or consent of the inventor, prejudice his right to a patent on application.

THE BESSEMER STEEL INTEREST.

A correspondent calls attention to the present workings of the Bessemer steel industry in the United States, with the remark that the patent Bessemer process is owned by eleven steel plants, who have an association for mutual protection, which prevents the establishment of any more plants in the United States. The agreement of this association is also that the same uniform scale of prices shall be maintained to the public; that any plant from necessity or choice remaining idle shall receive a bounty of $5 upon each ton produced by the plants in operation. If two plants were idle the tax would be $10 per ton; if five were idle the tax on product would be $25 per ton.

But one plant is now idle, the Vulcan Iron and Steel Company of St. Louis, whose capital is about $1,500,000 (?). The product of the ten plants in operation is 700,000 tons per annum. A tax of $5 per ton would give the Vulcan Works an income of $3,500,000.

The price of rails in the United States is $45. The price of rails in England is $25, and 15,000 tons were recently sold to go to Canada at $22.50 per ton. If the Vulcan Works were running the product would probably be increased by 100,000 tons, as these works have two of the largest converters in the world, and as they were the last built in the United States they have all the improvements in the process.

The *cost* of steel rails in America is less than $20 per ton. Is it not time that there were more converters, or a lower duty on steel rails? Are not these steel plants standing in their own light and inviting opposition to the present high duty? Is it strange that large railroad men should seek to punish these companies by purchasing in England?

It is reported that the present plants are driven to their utmost double turn to supply the demand, and that there is less attention paid to the character of the product, and that many rails break in laying. This is our correspondent's complaint; how far it can be contradicted we shall be happy to be informed.

INVENTIONS IN CHINA.

For a long period the Chinese Government directly discouraged invention and all other innovations upon established conditions and customs. The result was a fixedness in social and industrial affairs which has made China proverbial. That the stimulus of western civilization has made great inroads upon this particular phase of Chinese character, is apparent on all sides. We are inclined to think, however, that nothing quite so significant has appeared in this connection as the following imperial decree published in the Pekin *Gazette*, and bearing date June 13, 1879. It reads as follows:

The Censorate has memorialized us to the effect that Tung Yü-ch'i, an expectant sub-prefect in the province of Anhwui, proposes to construct a steamboat to be impelled by steam generated without the use of fire, which shall be so superior as to supplant the one using fire. Its construction is already well nigh completed, and it is estimated that 3,000 taels will suffice to finish it. A diagram with illustrations of the invention has been presented to the memorialists for their inspection. Should the steamer invented by the officer in question be found capable of quick motion and adapted to practical use, it will, of course, be proper to adopt it. We, therefore, command Shên Pao-chên to devise means for providing the 3,000 taels required to carry the invention into execution. He is further commanded, in conjunction with Li Hung-chang and Ting Jih ch'ang, to examine the diagram and the illustrations, and to give the matter his most careful consideration. As soon as the invention has been carried to completion it will be the duty of Shên Pao-chên and the high officials associated with him to put it to the test of an experiment and to report in a memorial to us whether it has been found, after all, to be adapted to practical use. We have this same day commanded the Censorate to instruct Tung Yü-ch'i to accompany Shên Pao-chên to Nanking. We have also commanded the Censorate to hand the diagram and illustrations to Shên Pao-chên for his perusal, and to communicate this decree to the several officials concerned.

The Cincinnati Exhibition.

The Cincinnati Industrial Exhibition was formally opened Sept. 10, with an address by President Hayes. The Governors of Ohio, Kentucky, and Indiana, with their staffs and a number of military organizations, also participated. President Hayes said:

"The seventh Cincinnati Industrial Exhibition is held at a most auspicious period in the commercial history of our country. The great business depression which followed the financial crisis of 1873, after five long and anxious years of distress, embarrassment, and bankruptcy, has at last been succeeded by a revival of prosperity, which is surely and rapidly extending to every branch of useful industry, with all values measured and made steadier by a currency which

is worth its face in the markets of the world; with business no longer perplexed and crippled by an uncertain and fluctuating standard; with credit which, according to Daniel Webster, is 'the vital air of modern commerce,' upon a sound and stable basis; with restored hopefulness and confidence, shared alike by the capitalist, the business man, and by the laborer; with agricultural crops and products abundant and readily salable at fair prices; with our manufactures seeking and finding a market in foreign countries to an extent never known before; with our natural burdens of debt and taxation becoming every year less difficult to manage and carry; with our country maintaining honorable and peaceful relations with all mankind; the merchants, the manufacturers, and the working men of Cincinnati may well be congratulated that at such a time their countrymen have assembled from far and near to enjoy and be instructed by this great Exhibition. We thank you for the invitation which we in such countless numbers have accepted; for your hospitality, and for your welcome to Cincinnati, a city which, standing, as it does, nearer than any other great city to the center of the population of the United States, may be rightfully called the 'Central City of America.'"

COPYRIGHTING FRUIT.

One of our contemporaries published a long account the other day of an Illinois nurseryman who claims to have secured a copyright on the propagation of certain varieties of cherries.

Our newspaper neighbor copied from the nurseryman's catalogue a description of his new cherries as follows: "Please take notice that the names, description, and numbers of these cherries are copyrighted, and therefore my individual and exclusive property, and any one infringing on my rights under the copyright laws of the United States, will be prosecuted," after which follows a list of his copyrighted cherries, which he offers to sell the trees of, to nurserymen in different states after they have purchased the copyright to grow them. He describes some forty-five new varieties, and says he shall produce some twenty more next year. The advertised price of the trees is 50 cents each, but he seems to be in more doubt about the value of his copyright, for he asks fruit growers to make a bid for the latter, but adds that no offer of less than $50 for a State will be accepted. Not crediting the advertiser's statement of having a copyright on his cherries we have caused search to be made in the Library of Congress and also at the Patent Office, and we learn that no such copyright has been granted from either bureau. For many years the subject of protection to horticulturists and others for new varieties of fruits and flowers has been discussed, but the difficulty of defining such discoveries, they being gradually brought to their perfection by the experiments of different gardeners, has prevented the possibility of legislation on the subject, and there seems no practical way of affording protection to such discoveries.

Sounding Niagara River.

The United States Corps of Engineers has recently had the Niagara river sounded, a task never before accomplished, owing to the bungling and unscientific means employed by those who attempted it. Bars of railroad iron, pails of stones, and all unreasonable bulky and awkward instruments had been attached to long lines, and cast off the railway bridge and elsewhere, but positively refused to sink. The very bulk of the instruments was sufficient, no matter what their weight, to give the powerful under-current a way to buoy them up upon the surface, or near it. By means of a small lead weighing twelve pounds, however, and a slender cord, the depths from the falls to the lower bridge were easily obtained. One of the sounding party says that the approach to the falls in a small boat was made with great difficulty. Great jets of water were thrown out from the falls far into the stream, and the roar was so terrible that no other sound could be heard. The leadsman cast the line, which passed rapidly down and told off 83 feet. This was quite near the shore. Passing out of the friendly eddy which had aided them in approaching the falls, they shot rapidly down stream. The next cast of the lead told off 100 feet, deepening to 192 feet at the inclined railway. The average depth to the Swift Drift, where the river suddenly becomes narrow, with a velocity too great to be measured, was 153 feet. Just under the lower bridge the whirlpool rapids set in, and so violently are the waters moved that they rise like ocean waves to the height of twenty feet. Here the depth was computed to be 210 feet.

THE SOCIAL SCIENCE ASSOCIATION.

The annual meeting of the American Social Science Association began in Saratoga, September 9, with a fair attendance of members. F. B. Sanborn, the acting Secretary, read a report giving an account of the origin, aim, and scope of the organization, which now has members in thirty-eight States and Territories. Touching the definition of social science, Mr. Sanborn said: "By strict rules it must be admitted that the term 'science' cannot be applied to our pursuits in the same sense that it describes the researches of the geologist, the chemist, or astronomer. There is a margin, however, in social science for much besides the close inductive or deductive processes by which Newton, Agassiz, or Faraday arrived at their splendid results. The methods of acquiring all human knowledge are essentially the same. The conduct of a nation in a grave political crisis is not to be calculated like the elements in an eclipse, yet it may be foreseen within certain limits. Many problems in social science are in their nature both scientific and philanthropic. What can be more prosaic than to be inspecting the entries and drains of tenement houses, the condition of sewers and water pipes, or inquiring about the rent of dirty rooms, the cost of pauper relief, the labor or idleness of a population hanging on the verge of pauperism? Yet this is exactly what the Social Science Associations of England and America, the only ones in the world, have been doing."

The second day, President Barnard, of Columbia College, read a paper on "International Coinage," and also presented his paper on "Monometallism, Bimetallism, and International Coinage," prepared for the Association for the Reform and Codification of the Law of Nations, at the August meeting in London. Mr. Barnard proposes to make one gramme of gold the standard of value, and to have the smallest international coin of ten grammes, equal to $6 less two cents.

President Porter, of Yale College, presented an able paper on "Modern Education, its Opportunities and Perils," which was read in his absence. One of the great perils was found in the circumstance that in aiming to be too scientific in form, modern education often fails to be scientific in fact—due very largely, we apprehend, to the antecedent circumstance that the text book makers and teachers lack an adequate training in genuine scientific methods.

The regulation and control of the degree-conferring power in American colleges formed the subject of another paper by President Barnard, who thought that if the multitude of superfluous collegiate institutions were deprived of the degree-conferring power, they would do no harm, and might, perhaps, do some good. France, Germany, Italy, and other countries of Continental Europe, are full of lycées, gymnasia, and colleges, where instruction in all branches is as extensive as in the average American college, and generally a great deal more thorough, but which are without power to confer degrees. The British colleges cannot confer degrees, not even those which form a part of the great Universities of Oxford and Cambridge themselves. All England, with a population of 23,000,000, has only four universities; the State of Ohio, with 3,000,000 population, has thirty-seven. All France, with a population of 36,000,000, has only fifteen universities, which, moreover, are actually branches of a single one. Germany, with a population of 42,000,000, has only twenty-two universities, or one to 2,000,000 of inhabitants. All Europe, with a population of 300,000,000, has only 101 universities, or one to 3,000,000 people. Our own country, with a population of 45,000,000, has 425 universities, or one to every 100,000 people. Further on, he spoke of the general weakness of our over numerous degree-conferring institutions, and remarked that a university, in a proper sense of the word, is a costly establishment. It cannot be created by a mere act of legislature. A flat university is worth no more than a flat dollar. We have some universities in this country whose resources are in some degree correspondent to their responsibilities; but we have not one whose power of usefulness is not constantly held in check by insufficiency of means.

Professor A. P. Peabody, of Harvard, read a paper on female suffrage in connection with school elections, in which he urged that women should vote and hold office in school matters, because they in general far surpass men in educational ability, tact, experience, knowledge, and wisdom. The work is proper for women, and they ought to do it. This point was put in a decidedly novel way. He said: "When our public schools came into being they were not meant for girls, the education of women being regarded as of little consequence. The schools were then properly, necessarily, under the charge of men. Now that women are men's peers, and more, as to culture, and receive this culture chiefly at the public charge, there remains no reason why they should not render to the public the reciprocal service of control, care, and government in the educational system of which they have become the most favored beneficiaries."

Chinese immigration was discussed in a long paper by Professor S. Wells Williams, of Yale, who advocated the admission of the Chinese to citizenship when they desire it. He claimed that the Chinese here are under the strongest national sanction of any race, and ought to be protected. They came here at the invitation of our own people, and brought with them industrious and quiet habits, and have added largely to the resources and wealth of this country.

George T. Angell, of Boston, President of the Massachusetts Society for the Prevention of Cruelty to Animals, presented the results of his investigations into the manufacture and sale of poisonous and dangerously adulterated articles. At the close of the paper, Mr. Henry C. Meyer, of this city, said that he had investigated Mr. Angell's previous statements in regard to adulterations, and had tests made, and could discover no such general system of adulteration as Mr. Angell reported.

In the evening the President of the Association, Professor Gilman, of the Johns Hopkins University, Baltimore, delivered the annual address. His subject was "American Education during the last Decade." He took the ground that the American public school system never stood so firm, or worked so well, as now. The most noteworthy administrative change of the decade has been the admission of women to the local school boards of Massachusetts, and the opportunity afforded them in the same State to vote for school officers. The most noteworthy pedagogical movement has been in the introduction of kindergartens, and in the attention bestowed upon drawing and vocal music.

The subjects considered September 11 covered a wide range, embracing questions of public health, law, the protection of workmen in mills, the treatment of criminals, and the like. Resolutions were adopted favoring the metric system and a system of international coinage based on the unit proposed by President Barnard—the gramme weight of gold nine tenths fine. The sewerage of village cities was presented by Colonel George E. Waring, Jr., and discussed by several members. It was also commented on at considerable length by Professor Acland, of the University of Oxford, England. The history of the tenement house system of New York was presented in a paper on the sanitary condition of tenement houses, by Dr. Charles P. Russell, of this city.

Professor William Watson, of Boston, read a report on the "Protection of Life from Casualties in the Use of Machinery," in which he reviewed what has been done in this country and abroad toward the prevention of such accidents, and described various devices for covering dangerous machinery.

President Anderson, of Rochester, discussed the relations of Christianity and the common law; Dr. Wharton, of Cambridge, the various theories of punishment for crime; Frederick H. Betts, of New York, the policy of the patent laws; and Professor Woolsey, of New Haven, read a paper on the United States and the Declaration of Paris in 1856. All the principles of the Declaration of Paris were declared to be in accord with the spirit and policy of our government.

RECENT INVESTIGATION INTO THE ACTION OF ANÆSTHETICS.

The third report on the action of anæsthetics to the Scientific Grants Committee of the British Medical Association has been made recently, the report embracing the results of investigating the condition of the blood pressure in animals under the influence of chloroform, ethidine, and ether. The experiments were made upon rabbits and dogs, and seem to have been performed with great care. The facts obtained from the observations, says the *Medical Record*, warranted the committee in reaching the following conclusions: Ether, when administered to animals, has no appreciable effect in reducing blood pressure; chloroform and ethidine have a decided effect in that direction.

Chloroform has sometimes an unexpected and apparently capricious effect on the heart's action. The occurrence of these sudden and unlooked for effects are a source of serious danger, because the blood pressure is with great rapidity reduced to almost zero, while the pulsations are greatly retarded or even stopped.

By ethidine the reduction of blood pressure is not, so far as has been observed, through sudden and unexpected depressions. Chloroform may cause death by primarily paralyzing either the heart or the respiration. Although not free from danger on the side of the heart and the respiration, ethidine is, in a very high degree, safer than chloroform, inasmuch as the former does not compromise the heart as does the latter.

A legitimate deduction from the facts given is that ether is by far the safest of the three anæsthetics used, and that ethidine is much safer than chloroform, and equally efficient.

A Notable Feature in the Iron Trade.

Some of the features of the present advance in iron, remarks the *Iron Age*, are worthy of note. It will be found upon inquiry, that in the case of most mills the increase in the volume of business has not come from gaining new customers, but from increase in the orders of the old. There may be some exceptions to this statement, but it will hold true generally. This indicates that there has been a decided increase in consumptive demand, and that both consumers and jobbers believe that this is a good time to stock up and to place orders for future consumption. Another feature of interest is that the increase has come without much drumming for trade; that is, the buyers have sought the sellers—a most healthy indication. It will be further found that, so far as price is concerned, the sellers are more conservative than the buyers. This is a somewhat paradoxical statement, but manufacturers are holding back, and are more fearful of the effect of a too rapid advance than the consumers. The true secret of many of the advances that have taken place during the past six weeks, will be found in the offers that buyers have made for iron for immediate delivery. We have mentioned a case where 2·20 cents was offered when 2 cents was the usual selling price, for a lot of iron that was needed in ten days.

Glass Shoe Patterns.

The question sometimes arises whether a patent can be obtained for the mere substitution of a special material for another in the manufacture of a well known article. In reply, we may state that if the Patent Office is satisfied that in consequence of the substitution a new and important result is obtained, a patent will be allowed. A recent case in point is that of an applicant who asked for a patent for making shoe patterns of glass. It was alleged against the applicant that glass patterns had been previously used for cutting out photo print ovals; also that sheet metal shoe patterns were in common use; and that there could be no invention in merely substituting therefor such a well known substance as sheet glass. But the Commissioner decided that the use of glass shoe patterns was a useful novelty, sufficient to support a patent, because such patterns enabled the cutter to see any defects in the leather and move the pattern to avoid them, which he could not do with the ordinary patterns. So the patent for glass shoe patterns was allowed.

The Devil's Darning Needle.

To the Editor of the Scientific American:

Though I regret being compelled to even appear to take issue with the eminent entomologist of Washington, I must beg to assert that my statement in your issue of August 16, in regard to the finding of a thick-thighed walking-stick in early spring, and in a pool of water, is not "founded on mistaken identity." I have been perfectly familiar not only with these insects, but also with the water-boatmen referred to by Professor Riley, for several years, and certainly would not confound them even at a casual glance; and I noticed one or two characters of the walking-stick quite particularly. I observed that the alternate brown and greenish transverse bands marking the femora were unusually distinct, probably on account of being wetted; and as it occurred to me at the moment that the females might occasionally survive and deposit ova in spring, I examined it to ascertain the sex, and found the curved clasping organs of the male insect at the extremity of the abdomen.

It should not be inferred from my statement of the size of very young individuals that the adults are so diminutive, nor from the finding of this specimen in the water that the species is properly aquatic. The specimen was perhaps three inches long, exclusive of the antennæ, and is the only one I have ever seen in, or even near, water. I simply placed the matter on record in the columns of your paper as being wholly anomalous, and, to me, utterly inexplicable.

Yours truly, W. J. McGee.

Farley, Iowa, Sept. 4, 1879.

The Catskill Mountains.

Professor Guyot has published a new map of the Catskill Mountains, the result of several summers' work in the Catskill region with his barometer and surveying instruments. He has measured the height of over two hundred places, determined by triangulation the positions of all the many summits, and discovered mountains that were not known to exist. A large part of the region, especially the southwestern, is an untracked wilderness of forests; and in several cases the only chance for making his triangulation was by climbing to the tops of the highest trees. He has found higher points than were before recorded, and many of them. His table of altitudes contains three peaks over 4,000 feet, thirteen over 3,800 feet, and thirty-six over 3,500 feet. The highest point is one of the previously unknown, Slide Mountain, in the Southern Catskills; its height is 4,205 feet above tide.

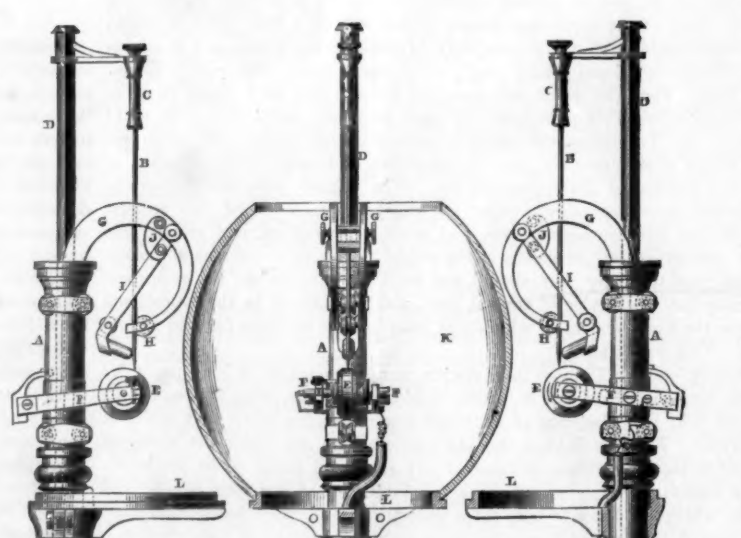
NEW FORM OF REYNIER'S ELECTRIC LAMP.

In 1878 Mr. E. Reynier observed the advantages presented by the effects of incandescence for the simple production and division of the electric light, and conceived the idea of uniting these effects with those of the voltaic arc. He therefore arranged the carbons, according to the Lodyguine system, so that it would burn at the point and furnish a small center of combustion at the point of contact. A small voltaic arc was thus produced.

In this lamp a slender rod of carbon is placed above a fixed and massive contact, either of carbon or metal, and is held in a vertical position by a heavy carbon holder. The carbon holder, by means of its weight, gradually pushes the carbon rod downward to replace the parts burned away. Cinders will collect at the point of contact if the ordinary carbons are used, but these cinders are thrown off by the rotation of the carbon disk. With this apparatus Mr. Reynier illuminated five lamps with a current from thirty Bunsen elements, and maintained the light in one of the lamps for more than a quarter of an hour with a secondary battery of three Planté elements.

Fig. 1 is a side view of the lamp without globe. Fig. 2 is a front elevation with section of globe and support. Fig. 3 is an elevation of the other side. A is the hollow supporting column with base; B is a slender carbon rod fitted to the socket, C, and retained by a screw. The vertical rod, D, supports the carbon rod, B, and slides in the column, A, on friction rollers. The carbon disk or cylinder, E, upon which the end of the carbon, B, rests, is supported in a forked arm, F. The carbon slides between the two cheeks of the curved guide, G. There is a small wheel, H, at the end of the guide, G, against which the carbon rod, B, rests, and an inclined lever, I, is pressed by the spring, J, against the carbon rod, and acts as a brake. A glass globe, K, covers the whole.

Mr. Reynier has made several models of his lamps. The last has a Carré carbon about 0·08 of an inch in diameter, held by a heavy carbon holder, which slides in a hollow column, and is provided with four friction rollers. The carbon rod rests on a carbon cylinder pivoted to a vertical arm of the column. A guide piece, provided with a brake, holds the carbon rod, and through this guide the current passes into the carbon rod, and from thence to the carbon cylinder, and returns to the battery. The point of contact is not directly over the center of the cylinder, but a little to one side, so that the cinders cannot accumulate.



REYNIER'S ELECTRIC LAMP.

A NEW COMBINED PUNCH AND SHEAR.

In our last two issues we gave brief descriptions of the new patent "Peerless" punching and shearing pendulum presses, Nos. 1 and 2, designed for comparatively light work. The one shown in the accompanying engraving is adapted to heavy work, and differs from the others in construction but not in principle. In the two presses previously described, the pendulum swings above the floor, and is actuated by treadle or hand lever. In this press the hand lever alone is used. It is designed for work as heavy as is usually done by large

"PEERLESS" COMBINED PUNCH AND SHEAR No. 6.

power presses, and is intended for railing makers, machinists, bridge builders, ship joiners, railroad contractors, and heavy iron working generally.

The work accomplished by it is astonishing, and we do not know of a hand press in the market performing as heavy work as this with but one man at the lever.

The pendulum swings below the floor, and is longer and heavier than in the presses before described. With one man at the handle, it punches easily an inch hole in three eighths bar iron, and $\frac{5}{8}\times\frac{1}{2}$, any distance from the edge; and shears $\frac{3}{4}$ bar, $2\frac{1}{2}$ inches at a cut. It has an open back, and will admit a plate 14 inches wide, and of course any length. The opening in the bed is 7x9 inches; stroke of slide $1\frac{1}{4}$ inch; adjustment of slide $1\frac{1}{2}$ inch. It weighs about 1,200 lbs., and occupies but one foot seven inches by two feet four inches of floor space.

The cross heads and connecting rods are made of steel, and the press is apparently very strong and substantially finished. We are informed that the manufacturers intend to exhibit the machines we have illustrated, in operation, every evening at the approaching exhibition of the American Institute in this city. The novelty of these presses will, doubtless, excite the curiosity of all practical machinists.

For further information, address the Peerless Punch and Shear Company, 52 Dey street, New York city.

A Strange Collision at Sea.

The Rotterdam steamship P. Caland, which arrived at this port September 9, brought the captain and crew of a Norwegian bark which had been sunk by collision with some sea monster in mid ocean. The bark Columbia left London for Quebec, in ballast, August 8, and met with variable weather until the morning of the 4th inst., when she was sailing at the rate of from six to seven miles an hour before a fair wind. The sea was not very rough, and the bark was carrying all sail and heading westward. The captain was on deck at five bells in the morning watch, when a tremendous shock, which shook the bark from stem to stern, was suddenly felt. The men who were asleep in their bunks were awakened, and thinking that the foremast had been carried away, sprang on deck. Capt. Larsen and three of his men ran to the port side and saw the water discolored with blood, while the tail and fins of a huge monster were seen splashing about in the sea, which had become violently agitated on that side of the vessel. At this moment one of the crew cried out that a leak had been sprung, and Capt. Larsen and the carpenter hurried down into the hold to see if the bark had suffered any injuries. In the port bow, about three feet below water mark, they found that four planks had been crushed in for a space about four feet long. A large hole had been made, through which the daylight above the water could be plainly seen. The water was pouring into the vessel through this hole. Several attempts were made to stop it up, but failing, the bark was abandoned and sank soon after. The captain and his crew of twelve men were fortunately picked up by the P. Caland the same day in the afternoon. No precise description of the colliding monster could be given The Columbia was an old ship, but about two years ago was put on the stocks and thoroughly replanked. Her bow was made of solid $4\frac{1}{2}$-inch oak planking.

MECHANICAL INVENTIONS.

Mr. John J. Kendall, of Greensborough, N. C., has patented a shingle machine, which is an improvement upon the shingle machine for which letters patent of the United States No. 166,784 were granted to the same inventor, August 17, 1875. The improvement cannot be clearly described without an engraving.

Mr. John F. Rakes, of Greenup County, Ky., has patented improvements in automatic car couplings, the object of which is to furnish means for holding the link and pin in position to immediately and surely engage each other when the cars are moved up in position to be coupled.

An improved car coupling has been patented by Mr. Colin Chisholm, of Los Angeles, Cal. This is an improvement in the class of car couplings in which the pin is so pivoted as to form a gravitating latch, which is thrust back by the disk when it enters the draw head, but immediately falls into the slot of the link, and thus completes the coupling. For uncoupling, the latch is raised by a chain and lever.

An improved device for locking the adjacent ends of railroad rails securely in place, so that they cannot rise out of line with each other under the pressure of passing trains, has been patented by Mr. Elijah F. Locke, of Apponang, R. I.

An improved ice boom has been patented by Mr. John B. Hansler, of Jersey City, N. J. It is designed for keeping cut or broken drift ice from floating farther up and down stream than is desired, and also to prevent ice from descending the rivers and entering the harbors. It consists of an arrangement of net work of iron rods and cables connected to floats, and joined to the shores, piers, or docks on either side, and arranged to swing open for the passage of vessels, and possessing sufficient elasticity to yield to the force of the current and tides, and to the impact of the floating ice, without breaking.

An improvement in wagon jacks for raising the axles to take off the wheels for greasing the spindles, has been patented by Mr. Andrew McClure Jones, of Birmingham, Ala. It consists of two bars, one serving as a standard and the other as a movable extension, to the upper end of which the lifting lever is fulcrumed. The adjoining faces of the bars are ratcheted, so as to engage each other, and connected together by bolts projecting from one bar through a vertical slot in the other, and furnished with thumb nuts, by which the upper bar can be secured at any desired height.

PRACTICAL EXPERIMENTS IN MAGNETISM, WITH SPECIAL REFERENCE TO THE DEMAGNETIZATION OF WATCHES.—No. 1.

BY ALFRED M. MAYER.

The extensive uses now made of electro-magnets in telegraphy, in dynamo-electric machines, and in the many practical applications of electro-magnetism, have greatly increased the risks of damage to watches by their magnetization. I have no doubt that in any one of our larger cities there are scores of watches safely packed away in drawers regarded as past recovery from overdoses of magnetism. They are looked upon by their owners as bullion kept in reserve for "a rainy day."

To be aware of the danger is not a sufficient guard against *accidents*. My own experience is a case in point: I had already silenced one watch, saturating it with magnetism by approaching an electro-magnet in my laboratory which had been allowed to remain in action by the person who had that day used it in his experiments. After purchasing another watch, I always took the precaution to place it on my office table before I approached the large electro-magnet of the Stevens Institute of Technology. I always did this, no matter whether the magnet was or was not in action. But one day I was suddenly called out of the room and detained by a visitor for a half hour or more. I took my watch from the table as I passed out of the room. I returned to my laboratory with my mind entirely engrossed with the experiments I had in hand, walked up to the magnet, rearranged the apparatus, and charged the magnet. My watch at the time was not 3 inches from the pole of this huge magnet! I was only aware of my "accident"—call it, if you will, thoughtlessness about the watch or thoughtfulness about the experiments—when that afternoon I leisurely walked to the station to take a train, and was informed that "it had gone over half an hour." My watch had lost half an hour in about three hours! Persons more cautious than I have had the same experience, for it is impossible, without idiocy supervening, to be constantly thinking of a watch. I have also remarked that out of the two or three dozen owners who have had watches apparently ruined by this same large magnet, each one considered "the other feller" a careless and *thoughtless* person until his turn came to do the same thing, when he was in a really *thoughtful* mood—about something, *which was not his watch*.

My last magnetic accident turned my thoughts to ways of taking the magnetism out of watches. I have succeeded perfectly, and the process which I have finally adopted as the best is so simple that any one can practice it, and that, if you wish, without even detaching your watch from its chain.

Though the process is simple, yet, of course a knowledge of the elementary facts and laws of magnetism is required to understand *how* it is done; and I know that every intelligent American mechanic really wishes to understand the reasons for performing the operations that he may be called on in practicing any new process.

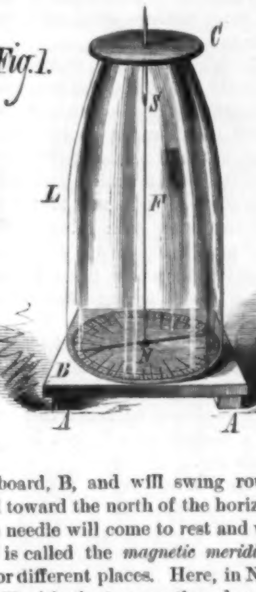
To render clear to all the operations used in *demagnetizing* (that is, in taking the magnetism out of) a watch, I will assume that I am addressing those who have little or no practical experience as experimenters in magnetism, and also those who wish to be at the least expense in practicing watch demagnetization. I will, therefore, explain the facts and principles of magnetism on which the operations depend, by describing actual experiments made with apparatus which is so cheap and homely that it can be made by any one with a very little trouble and at a trifling expense.

I will at once proceed to show how to make the simple instruments required in our preliminary experiments and in the demagnetization of a watch.

The Magnet may be made out of a piece of a large rat-tail file. The one I have used is 7 inches long and averages $\frac{3}{8}$ of an inch in diameter. There is something either in the quality of the steel or the temper of these files which makes them capable of receiving powerful charges of magnetism. The most powerful magnet I have ever examined is the rat-tail file just spoken of. It lifts several times its own weight. If a large rat-tail file cannot be had, then a piece of Stubs steel, 10 inches long and $\frac{1}{2}$ inch in diameter, must be obtained. This steel rod must be first heated to cherry red, and then lowered gradually, while in an upright position, into a bucket of water. This will render it hard and capable of receiving and retaining a magnetic charge. The file or steel rod is magnetized either by drawing it over the pole of a powerful electro magnet, or by wrapping around it insulated copper wire, and passing through the wire a current of electricity from a galvanic battery.

The Magnetometer.—We call thus the small magnetic needle suspended in a glass shade by a fiber of silk, Fig. 1. It is made thus: Take a No. 4 or 5 needle, and draw it several times, from point to eye, over the N. end of your magnet. This operation will magnetize the needle, and when suspended from its middle, its pointed end will point toward the north. Now, on to a piece of wood, B, which is 3 inches square, glue and screw the slips, A and A, across its grain, so that it cannot warp. Then on its upper side paste a piece of damp white drawing paper. When this has dried it will be tightly stretched on the piece of wood. Draw on the paper a circle slightly larger in diameter than the length of the No. 4 needle. Divide one half of this circle off into 180 parts of one degree each; or, if that be too tedious, divide the semi-circumference into ninety equal parts of two degrees each. To suspend the needle, you get a skein of floss silk, such as is used in embroidery. This silk is untwisted, and from it you can readily draw a thread formed of a few fibers, which is very delicate and without the slightest twist or torsion in it. To suspend the needle, stick to its middle a small dot of wax. Then press the end of the silk thread into the wax and work the wax over it with the fingers. The other end of the thread is passed through the eye of a large No. 1 or 2 needle. This needle is then passed through a hole in a piece of cardboard, C, placed on top of the lamp chimney, L. The silk thread must be of such a length that when the needle is pushed downward through the hole in C, the magnetic needle, N, may be brought to rest on the paper covering the block, B. Now, on slightly drawing up the needle, S, the magnetic needle, N, will hang just above the board, B, and will swing round with its pointed, or N., end toward the north of the horizon. After many oscillations the needle will come to rest and will point in a direction which is called the *magnetic meridian*. This direction is different for different places. Here, in New York, it makes an angle of 7° with the true north and south line, and the N. end of the needle points 7° to the west of the true north. This pointing of a suspended needle away from the true N. is called its *magnetic declination*, or magnetic variation. In New York and its vicinity the magnetic declination is 7° west.

Fig. 1.



In addition to the magnet and magnetometer the experimenter will need the following materials:

Three pieces of soft iron. One piece 12 inches long and $\frac{3}{8}$ inch in diameter; another piece, 3 inches long and $\frac{1}{4}$ inch in diameter; a third piece, 1$\frac{1}{4}$ inch long and $\frac{3}{8}$ inch in diameter. These pieces of iron should be made very soft by heating them to bright redness and then allowing them slowly to cool in hot ashes.

A piece of steel wire, 6 inches long and $\frac{1}{16}$ inch in diameter.

Iron filings, made from soft iron and passed through a fine sieve.

Pieces of window glass. Two 12 inches by 6, and two pieces 6 inches square.

A small bottle of spirit varnish, such as photographers put over their negatives.

Needles, nails, and tacks of various sizes.

With the above simple and cheap things a great many interesting and beautiful experiments can be made; and we will now show how to obtain from these homely instruments much information that is really sound and useful.

Experiments showing in what a Magnetic Substance differs from a Magnet.—Place the magnetometer on the table and allow the magnetic needle to come to rest. Now take the piece of soft iron 3 inches long and bring it slowly up to the magnetic needle, always keeping the piece of iron pointing toward the point of the needle, as shown in Fig. 2. You will observe that the point of the needle moves toward the iron, turning around its center, C, in the direction shown by the arrow.

Fig. 2.

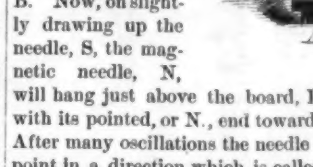
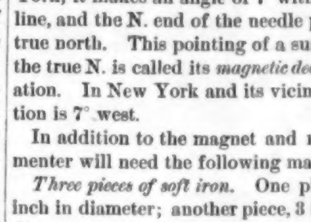


Fig. 3.



Slowly and steadily draw away the piece of iron. As you do so the needle slowly turns on its center, C, and comes again into the magnetic meridian. Now bring the piece of iron up to the eye end of the needle, and you will see that this end turns toward the iron in the same manner as did the point of the needle in the previous experiment. Thus we find that a piece of soft iron attracts either end of the magnetic needle. Each end moves toward the iron. If this be so, it necessarily follows that if you point the piece of iron directly toward the center of the needle and bring it up to the needle in this position, keeping care always to have the length of the piece of iron at right angles to the length of the needle, the needle will not move, but remains steadily pointing in the magnetic meridian. Each end of the needle is equally attracted toward the iron, and as each end tends to turn in the direction shown by the arrows in Fig. 4, it remains at rest under the action of two equal forces tending to rotate the needle in opposite directions.

Now we will make some experiments similar to those just described, but differing in this: we use a magnetized No. 1 sewing needle instead of the piece of soft iron. Take a No. 1 sewing needle and draw it from point to eye over the N. end or pole of your rat-tail file magnet. You will, by this operation, have converted the needle into a magnet, and if you suspend it, as I wish you now to do, like the needle of your magnetometer, you will find that *it points in the magnetic meridian with its point toward the north*. The ends of magnets, or, more accurately speaking, certain points in the center of magnets and *near* their ends, are called *the poles of the magnet*. To distinguish these two poles, they are respectively called north pole or south pole, corresponding to the end of the needle which points toward the north or south geographic pole. The points of our magnetized needles are, therefore, north poles, while their eye ends are south poles.

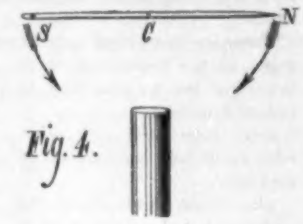


Fig. 4.

Bring the No. 1 needle up to the needle of the magnetometer, with its point toward the point of the magnetometer needle and with its length always at right angles to the magnetic meridian, as shown in Fig. 5. The N. pole of the needle moves away from the north pole of the No. 1 needle, and we here have *repulsion* instead of attraction, as we had when the piece of iron was placed in the same position. Now point the north pole or point of the No. 1 needle toward the eye end, or south pole, of the magnetometer needle, as shown in Fig. 6. In this position of No. 1 needle, the S. pole of the suspended needle moves toward the N. pole of the No. 1 needle. So in this experiment we have attraction of the S. pole toward the N. pole. Thus we have found out that the north poles of magnets repel each other, while the north pole of one magnet attracts the south pole of another magnet. This being the case, it follows that the No. 1 needle, attracting the S. pole of the suspended magnet and repelling its N. pole, must, when pointed at right angles to the suspended needle and directed toward its center, C, cause the suspended needle to rotate, its S. pole moving toward the point of the No. 1 needle, as shown in Fig. 7.

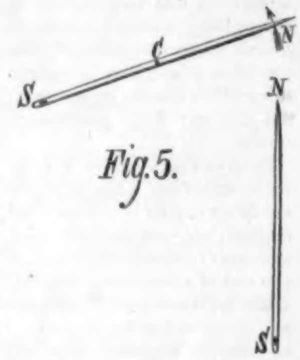


Fig. 5.

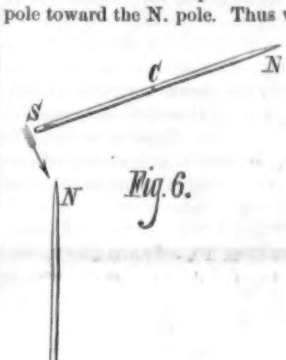


Fig. 6.

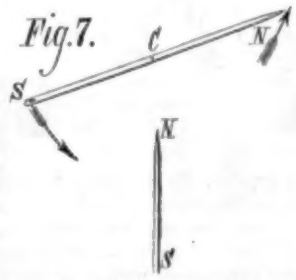


Fig. 7.

The experimenter must now compare this experiment with the similar one with the piece of iron. The iron when pointed toward the center of the magnetic needle did not rotate it, but when the magnetized needle is placed in the same position the suspended needle rotates and its N. pole moves away from the N. pole of the No. 1 needle.

Let us vary these experiments by pointing the eye end, or south pole, of the needle first toward the N. end and then toward the south end of the magnetometer needle, and then toward the center of this needle. Figs. 8, 9, and 10 show the results of these experiments. They differ from those of Figs. 6, 7, and 8 in this: the south pole of the magnetized No. 1 needle acts on the suspended needle in place of the north pole. The results are as follows: The S. pole of the No. 1 needle repels the S. pole of the suspended needle and

Fig. 8.

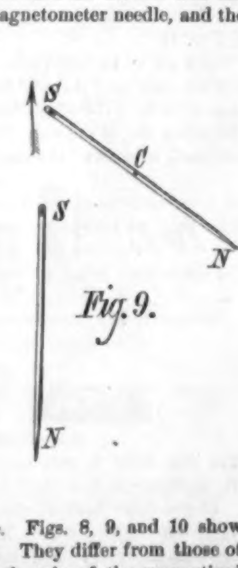


Fig. 9.

attracts its N. pole; and consequently when its eye end is pointed toward the center, C, of the suspended needle the latter has its N. end pulled toward the No. 1 needle and its S. end repelled. It necessarily turns around its center, C., its N. pole moving toward the eye end or S pole of the No. 1 needle.

These are very simple experiments, yet they have already given us the knowledge of an important law, which may be summed up thus:

Like poles repel each other, while unlike poles mutually attract each other.

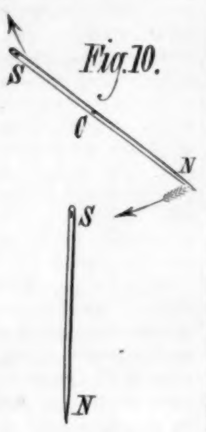


Fig. 10.

These experiments also give us a practical and easy method of determining whether a body is merely *a magnetic substance* like our piece of soft iron, or a piece of nickel or cobalt; or is a magnet like our No. 1 magnetized needle.

Each end of a bar of a magnetic substance attracts either the N. or S. pole of a suspended magnet; but *a magnet has poles*, and one of its ends acts to attract one end of a suspended magnet, while the other end of the magnetic bar will repel the same end of the suspended magnet. Hence to tell whether a certain bar is a magnetic substance or a magnet, we place it with its length at right angles to a suspended magnet and pointing toward its center. If in these circumstances the suspended magnet remains at rest then the bar is formed of a magnetic substance, or one which has no action whatever on a magnet. To determine whether the latter is the nature of the bar, we bring one of its ends near an end of the suspended magnet; if the latter remains at rest, then the bar is formed of a substance which has no sensible magnetic action on the suspended needle. If, however, the suspended magnet turns when the bar is placed at right angles to its length, then the bar is a magnet, and the end of it which is toward the needle is the pole which is of the same name as the pole of the suspended magnet which moves away from the bar.

With the magnetometer we may, therefore, determine the name of the pole of a magnet by the direction in which the magnetometer needle moves, and we can compare its intensity with another magnet by observing the number of degrees of the circle over which the needle rotates.

These experiments on the mutual attractions and repulsions of magnets may be modified in a very pleasing manner


Fig. 11a.


Fig. 12.

by allowing a No. 1 magnetized needle to adhere from the end of a piece of soft iron, and approaching to the free end of the needle first one pole and then the other of the magnet. Figs. 11a, 12, 13, and 14 may serve to clearly show the different phases of these experiments without further explanation.

Experiments in Magnetic Induction.—Pour some iron filings on a sheet of paper and roll your rat-tail file in them. Lift the magnet from the paper and you will see that the filings stick in the form of bristles or brushes to the two ends, and at some distance from the two ends of the magnet, but to the middle portion of the magnet no filings adhere, as is shown in Fig. 11.

Stick the end of the piece of soft iron in the filings; you will see that they do not adhere. Now stand the piece of iron upright in the filings and bring the rat-tail file down on the upper end of the iron. Lift the magnet, and the iron, you will find, adheres to the magnet; also, you will observe that

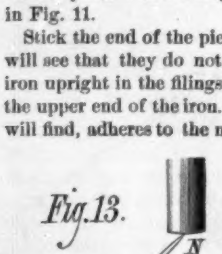


Fig. 13.

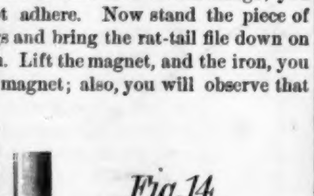


Fig. 14.

the iron itself is now magnetic, for the filings adhere to it, as shown in Fig. 15.

If you take hold of the piece of iron with one hand and then detach the magnet, lifting it above the iron, you will see that the iron loses its magnetism, for the filings fall when the magnet is removed to a distance from the iron. Yet it is not necessary that the magnet should actually touch the iron to render it magnetic, for you will find that the iron will attract the filings and cause them to adhere to it even when the magnet is held at a short distance above the end of the iron, as shown in Fig. 16, though the quantity of iron filings which it is capable of holding, and consequently the strength of its magnetism, is less than when the iron adhered directly to the magnet.

The above experiment is modified in an interesting manner by using different sized nails, brads, and tacks in place of the filings.

In this experiment, represented in Fig. 17, the magnet has directly adhering to it a large nail. This nail is thus made a magnet, and it in turn holds up a smaller nail, and this a yet smaller one, which in turn supports a brad, and this brad a smaller one, and to this sticks a tack, and to the tack adheres some iron filings. Each nail in turn acts on the nail or tack which adheres to it, just as the magnet acts on the large nail directly adhering to it.

Thus it is seen that the magnet *induces* the iron to become a magnet like itself when it touches the iron or is held near it; hence this action of a magnet on soft iron is called *induction*.

We will now repeat these experiments in induction, but we will use a piece of steel in place of the soft iron. Select a short thick sewing needle that contains no magnetism. Of this you may be sure if, when the needle is pointed toward the center of the magnetometer needle, and at right angles to its length, it does not cause the latter to rotate. If the needle, when dipped in iron filings, does not cause them to adhere to its ends it will be free enough of magnetism for our experiments.

Having tested the needle and found it free of magnetism, you now hang it to the end of the rat-tail file magnet and bring its free end into the filings. They now adhere to the needle, as shown in Fig. 18.

Hold the needle between the fingers of one hand and remove the magnet to a distance with the other hand. You now see that the needle behaves differently from the piece of soft iron, for when the magnet was removed from the latter the iron filings dropped from its end, but in the case of the needle the filings remain suspended. In other words, the


Fig. 15.

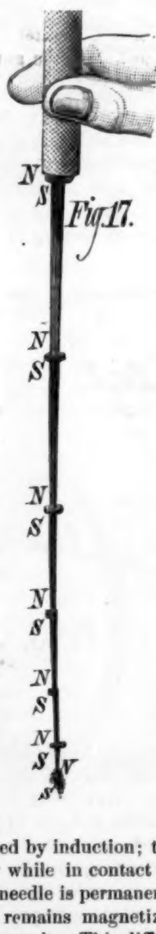


Fig. 17.


Fig. 16.

iron is only temporarily magnetized by induction; that is to say, it remains magnetized only while in contact with the magnet. On the other hand, the needle is permanently magnetized by induction; that is, it remains magnetized after the magnet has been removed from it. This difference in the after effects of induction on soft iron and steel is best observed in the following experiment.

Take a piece of the softest iron, and having ascertained that it is entirely free of magnetism, draw it repeatedly over the end of the magnet; if the iron is really soft you will find that even repeated stroking on the magnet cannot give it the power of attracting the filings. However, generally the iron will retain a slight, though often very slight, amount of magnetism, and will cause a few particles of filings to adhere to it. Now perform the same experiment with a large sewing needle, and observe how powerful a magnetic charge has been given to it. When rolled in the filings large tufts adhere to its ends, surprising those who have never seen before how strong a magnet may be thus made of a large sewing needle.

This retention of a magnetic charge by steel enables us to readily fashion magnets of any form and size. If steel or some other easily worked body had not this property we would be obliged to construct our mariner's compass needles out of the hard and brittle calamite or loadstone. Indeed, it would be difficult to select from the whole range of the special properties of matter one more valuable to man, or more necessary to his present high and widely spread civilization, than this one of the capability of steel to receive and retain the properties of the loadstone.


Fig. 11.

Further Experiments in Magnetic Induction.—Let us, by means of other simple experiments, examine more minutely into the nature of this magnetic induction.

Take two pieces of very soft iron wire and suspend them by silk fibers, as shown in Fig. 19. Hold the ends of the fibers separated, between the thumb and forefinger, so that the wires may hang a quarter of an inch or so apart. Now bring them slowly down toward the N. end of the magnet, as shown in Fig. 19. They now no longer hang parallel to each other,


Fig. 18.


Fig. 20.


Fig. 19.

but are inclined, the upper ends of the wires repelling each other, so that the two suspending threads are forced outward and no longer hang vertically. This repulsion between the upper ends of the soft iron wires is caused by their having the same magnetic polarity. We have already seen that like poles mutually repel. (See experiments described in Figs. 5 to 14.) If the N. pole of the magnet is pointing upward, as shown in Fig. 19, then the lower ends of the suspended iron wires are of S. polarity and their upper ends are of north polarity.

The experiment just described may be modified by simply


Fig. 22. Fig. 21.

holding the two wires parallel to each other between the thumb and forefinger and bringing their ends to touch the end of the magnet. They will adhere to the magnet, and on relieving the wires between the thumb and finger they will at once fly apart, from their mutual repulsion, as shown in Fig. 20.

Take seven pieces of iron wire, each about 1 inch long, and run them through small corks, about $\frac{1}{4}$ of an inch long and $\frac{3}{16}$ inch in diameter. Throw these pieces of wire into a

bowl of water and they will float vertically. They will come to rest at various hap-hazard positions on the water. Evidently there is no order in their arrangement. Now take your rat-tail file magnet and, holding it in a vertical position, bring it over the water in the bowl. At once the pieces of wire sail toward the magnet, and after many motions among themselves they at last take up the definite figure of a hexagon with a floating wire in its center, as shown in Fig. 21.

This is a beautiful illustration of magnetic induction, and this experiment tells the whole story when viewed in the light which another gives, and which will be at once described before speaking further of the one just made.

Take seven sewing needles; "Milward's No. 6 betweens" are good for this experiment. At the N. Y. Cork Cutting Co., 45 Fulton street, New York, you may buy a gross of corks, of ½ inch in length and $\frac{1}{16}$ inch in diameter, for 10 cents. Magnetize each needle by drawing it from point to eye end over the N. end of your rat-tail file magnet. Then run each needle through the center of a cork made by halving one of the corks just described. In other words, the corks which will float these needles are ¼ inch long and $\frac{1}{16}$ inch in diameter. Now throw these needles in the bowl of water. They repel one another, and if time enough be given them they will at last reach the edge of the bowl and will arrange themselves at equal distances apart around the border of the water. They do so because when floating upright their like poles are opposed to each other, as shown in Fig. 22, and these like poles mutually repel.

While the needles remain on the border of the water in the bowl, bring down vertically the rat-tail file over the center of the water, with its N. pole pointing downward. The magnetic needles at once rush toward the middle of the bowl, and after moving about each other for a while they end by forming the same regular geometric figure of the hexagon, with a needle in its center, as happened in the experiment with the floating iron wires, shown in Fig. 21. In the experiment with the magnetic needles we know the exact magnetic conditions of the experiment. We know that the needles are magnets, and that their south poles are pointing upward and their north poles are down in the water. The like poles of these needles being opposed, they mutually repel, and keep apart till the N. end of the magnet has been brought over them; then this strong north pole attracts the upper or south poles of the needles, and they draw toward the N. pole of the magnet. In other words, the attraction existing between the N. pole of the magnet and the south poles of the needles is stronger than the repulsive force existing between the needles. The needles therefore move toward the magnet and approach one another till their mutual repulsive actions keeping them apart just balance the attraction of the magnet which tends to bring them together.

If the magnet be held at rest, the figure of the hexagon remains at rest; but if the magnet be slowly raised, the hexagon enlarges as the magnet goes further off from the hexagon, for in this case the attractive action of the magnet diminishes. If, however, the magnet approaches the hexagon, the latter shrinks in size, for the attractive force of the magnet on the hexagon increases, and the needles approach till their increased mutual repulsion exactly equals the increased attraction exerted by the magnet on them when the magnet is nearer the hexagon.

If the reader's interest should be excited by the description of these new experiments in magnetism, he will find in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 129, an extended description of them and of the phenomena which they may serve to explain and illustrate, with a full set of the various figures found by different numbers of floating magnets.

Now let us return to our experiments with the floating iron wires. These wires were not magnetized, therefore they did not repel one another when thrown into the bowl of water. They differed from the magnetic needles in this, and hence did not drive one another toward the border of the bowl. But when the magnet was brought over them they acted precisely like the magnetic needles, and formed the same regular hexagon with a floating wire in its center. The force acting on the wires and the needles was the same. It was the N. pole of the magnet. We know that the needles will only move toward the N. pole of the magnet when their south poles are upward and their north poles are down in the water. The wires did the same, and we therefore have a right to assume that when they moved toward the N. pole of the magnet their upper ends were made south poles by the inductive action of the magnet, and their lower ends, under the water, were made north poles by the same action.

We can now understand the condition of the polarity in the magnetic chain formed by the suspended nails, brads, etc., in the experiment shown in Fig. 17. To the N. pole of the magnet is attached a nail. The end of the nail touching the magnet is made its south pole by induction, while its other end is made its north pole. This nail now acts just like the magnet which magnetized it, and the nail in turn magnetizes by induction nail No. 2, and this nail No. 3, and so on to the end of the magnetic chain, which is terminated by the magnetized iron filings.

(To be continued.)

A New Blue Dye.

Reichenbach's wood-tar color, pittacal, has been resuscitated by A. Grätzel, and it is now an article of commerce at the price of £4 per kilo, under the formidable name of "German-Imperial-Flower-Blue," with reference probably to the blue corn flower, which is said to be the favorite cognizance of the German Emperor. The pure base is insoluble in water, but dissolves in every acid, and the solutions can be diluted to any extent. The acetate is generally used for dyeing, dissolved in a little acetic acid diluted with water, and almost neutralized with ammonia. In this bath, silk and wool take a fine reddish blue without the aid of any mordant. Cotton and other vegetable fibers are prepared with a solution of tannin, followed by a solution of tartar emetic. The colors produced are perfectly fast.—*Reimann's Färber Zeitung.*

Gelatine Photo Plates.

Many amateurs—and, for that matter, professionals also—who would otherwise practice the gelatino-bromide process, are deterred from so doing by a consideration of the difficulties which attend the preparation of the emulsion in hot weather, its limited keeping qualities, and the consequent necessity for making repeated small batches instead of "going in" for a large quantity at once, and thus securing, at least, a fair chance of uniformity throughout a large number of plates.

The plan I am about to describe is one which removes these difficulties; and I can recommend it on the score of efficiency, having for some time worked it myself. But to the users of small quantities of emulsion it offers especial advantages, as it enables them to emulsify a considerable quantity of silver bromide at one operation, and keep it in a convenient form for adding to the requisite quantity of gelatine just when the emulsion may be required for use.

The operator is thus relieved of the trouble of having continually to attend to the "cooking" arrangements of his emulsion, and, what is of equal importance at this season, the gelatine itself is for so short a time in contact with moisture that the chances of decomposition are reduced to a minimum, and the tendency to frilling and other evils diminished.

To make the emulsion proceed as follows: Dissolve 300 grains of gum arabic in ten ounces of distilled water; put the water in a wide-mouthed bottle, and the gum—together with a piece of chalk the size of a hazel nut—in a piece of muslin suspended therein. The chalk is to prevent any tendency on the part of the gum solution to turn acid. Take of the above four ounces, and dissolve in it eighty grains of ammonium bromide. To sensitize, dissolve 125 grains of silver nitrate in two ounces of water, and add a little at a time to the bromized gum solution, shaking well between each addition. When all the silver has been added put aside to digest.

A gelatine emulsion may be made at any time by adding to each ounce of the above thirty grains of gelatine; when soaked dissolve in a water bath, allow it to set, wash, redissolve, and coat. Or the gum emulsion may be dialyzed to remove decomposition salts, in which case it may be kept for a very considerable time without any change in its sensitiveness or general character. It would, however, be then advisable to reduce the proportion of gum, as it must be borne in mind that there is no washing to remove the gum, which, therefore, remains in the gelatine film.

To sum up, the advantages are:

1. Emulsification may be prolonged to any extent.
2. The bromide of silver will remain perfectly in suspension in the temporary menstruum.
3. A large quantity may be made, and portions taken at intervals as required.
4. The gum being very soluble, and permeating the jelly, the salts are more easily got rid of in washing.
5. Heat is not required, except to dissolve the gelatine.

Those whose patience is being tried by the vagaries of gelatine during this weather should try the foregoing, which will, I think, in the majority of cases, prove an effective cure.—*Peter Mawdsley, in British Journal of Photography.*

Combination of Cyanogen with Hydrogen and with Metals.

The author having measured the heat of the formation of hydrocyanic acid and of cyanogen from their elements (— 14·1 and — 38·3), concludes that the synthesis of hydrocyanic acid from cyanogen and hydrogen ought to evolve a considerable quantity of heat. He finds that gaseous hydrocyanic acid may be heated to 550° for three or four hours in a sealed tube without betraying any marks of decomposition or dissociation. The author effected the direct combination of cyanogen and hydrogen by heating the pure dry gases in equal volumes in a sealed tube of hard glass to 500° to 550° for several hours. On opening the tube a loss of about one seventh of the volume was apparent, due to the formation of a certain quantity of para-cyanogen. Potassa absorbed five sevenths of the gas, and the residual one seventh was found on analysis to consist of water almost pure. The volume of this residual hydrogen being sensibly equal to the original condensation (representing the change of a certain quantity of cyanogen into para-cyanogen) it follows that the gas absorbable by potassa is hydrocyanic acid exempt from free cyanogen. At a lower temperature the synthesis is less complete, and at greater heats a portion of nitrogen is set free. At 300° cyanogen combines with zinc, cadmium, iron if brought in contact in a sealed tube.—*M. Berthelot.*

Laws of Atmospheric Electricity.

Atmospheric electricity presents daily in Piedmont two maxima following the rising and setting of the sun, at an interval of some hours. These two maxima are separated by a minimum which follows the passage of the sun over the meridian of the place. As regards the annual fluctuation the maximum value of the atmospheric tension falls in February, and the minimum in September. Before and after storms the electrometer almost always marks zero, but during their passage or proximity the tension is very great. Rain and snow increase tension more slightly, and are often preceded and followed by electric diminution. The action of fogs, hoar frosts, and of the formation of clouds increases atmospheric electricity, though to a less extent than that of rain and snow. In calm and hot weather the lowest values are observed. South and especially southeasterly winds increase the electricity of the air; north winds have an opposite effect. Rain and snow are accompanied by negative electricity, at least as often as by positive. The same proportion holds good for storms and to a less extent for rain and snow. Negative electricity is generally due to storms or rain at a distance, to the formation of clouds, or to a polar aurora. In the normal conditions of the atmosphere electric tension decreases with altitude.—*P. F. Denza.*

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

The computations in the following notes are by students of Vassar College. Although only approximate, they will enable the ordinary observer to find the planets.

M. M.

POSITION OF PLANETS FOR OCTOBER, 1879.

Mercury.

On October 1 Mercury rises at 5h. 41m. A.M., and sets at 5h. 38m. P.M.

On October 31 Mercury rises at 8h. A.M., and sets at 5h. 27m. P.M.

Venus.

On October 1 Venus rises at 5h. 14m. A.M., and sets at 4h. 34m. P.M.

On October 31 Venus rises at 3h. 11m. A.M., and sets at 3h. 9m. P.M.

The motions of Venus can be watched by referring the planet's places to the stars in Leo, and it will be seen that Venus moves toward the west until the 14th, and toward the east after that date. Venus is near the waning moon on the 12th, and at its greatest brilliancy on the 30th.

Mars.

Mars is coming into better position for evening observers. Mars rises on October 1 at 7h. 57m. P.M., and sets at 10h. 12m. of the next day.

On October 31 Mars rises at 5h. 39m. P.M., and sets at 7h. 56m. A.M. of the next day.

After October 6 the motion of Mars among the stars will be toward the west; it can be compared with the stars of the Pleiades. Mars is in conjunction with the moon on the 30th.

Jupiter.

Jupiter, Saturn, and Mars are brilliant in the evenings of October.

Jupiter rises first: on October 1 at 4h. 25m. P.M., on October 31 at 2h. 24m. P.M.

An ordinary ship's glass, or a good opera glass, will show the varied positions of Jupiter and its four moons. If we take the hours between 8 and 10 in the evening for our observations we shall see Jupiter rise, unaccompanied by its first satellite, on the 5th, in consequence of the satellite coming in front of the planet and passing across the disk. The same will occur on the 21st and 28th.

The first satellite will be invisible at some time during these hours on the 6th and 29th, because it is in the shadow of the planet. On the 20th it will not be seen, because behind the planet.

The smallest satellite of Jupiter, the second in order of distance from the planet, will not be seen until near 10 P.M. on the 7th, when it passes from the face of the planet. It will disappear about 9 P.M. on the 14th, because it passes between the planet and the earth and is thus projected upon the face of Jupiter.

The third satellite of Jupiter, which is the largest, will disappear by going behind the planet, October 9. The approach of the satellite and planet can be watched, and its motion around Jupiter can be followed; it will reappear after midnight. This satellite will pass across the disk of Jupiter between 6 and 10 P.M. of the 27th; it will be seen to pass from the face of Jupiter between 9 and 10 P.M.

The fourth satellite of Jupiter will reappear from the shadow of Jupiter on the 25th, between 8 and 9 P.M.

Saturn.

Saturn comes to its best position early in October. A small telescope will show the ring projecting on each side the planet.

Saturn rises on October 1 at 6h. P.M., and on October 31 at 3h. 56m. P.M.

Saturn is in conjunction with the moon on the 27th at midnight, Saturn being about 8° south of the moon.

Uranus.

On October 1 Uranus rises at 3h. 20m. A.M. On October 31 Uranus rises at 1h. 29m. A.M.

Uranus is very near the star Rho Leonis.

Neptune.

Neptune rises on October 1 at 7h. 7m. P.M., and on October 31 at 5h. 7m. P.M.

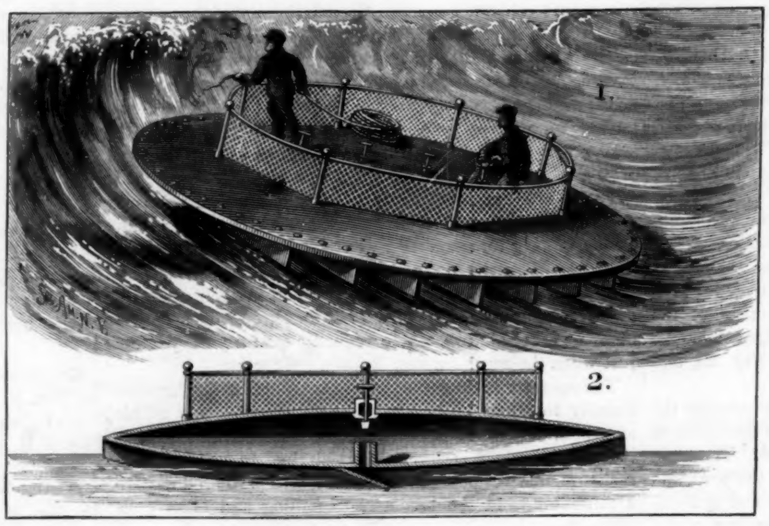
Between 4 and 8 P.M. of October 1, Jupiter, Saturn, Neptune, and Mars come above the horizon; and on the 31st the same planets rise between 2 and 6 P.M.

AN immense steel bridge is now in progress over the Frith of Forth, in Scotland.

A NEW SURF BOAT.

The accompanying engraving represents a novel surf boat recently patented by Mr. Richard H. Tucker, of Wiscasset, Me. The boat is circular in form, with convex upper and lower surfaces, and its entire interior forms a reservoir for holding compressed air to be used in the propulsion of the boat. The propelling device is very simple. It consists in air nozzles projecting toward the stern, one being placed in each between the keels, of which there are several. The air nozzles are provided with valves which are operated from the deck. The boat is steered by closing the air valves on one side or the other as may be required.

This boat is not designed for long distances, but it is claimed that it has propelling power sufficient for ordinary requirements. It certainly contains no machinery which can become impaired either by use or rest, and it possesses sufficient buoyancy and is of the proper form to maintain its proper position in the water.



TUCKER'S SURF BOAT.

Reaping 20 Square Miles of Wheat.

The poetry of the harvest field will have to be rewritten. A correspondent of the Chicago *Tribune*, writing from the Dalrymple farm, furnishes the rough materials for one canto.

"Just think," he says, "of a sea of wheat containing twenty square miles—13,000 acres—rich, ripe, golden; the winds rippling over it. As far as the eye can see there is the same golden sunset hue. Far away on the horizon you behold an army sweeping along in grand procession. Riding on to meet it you see a major general on horseback—the superintendent; two brigadiers on horseback—repairers. No swords flash in the sunlight, but their weapons are monkey wrenches and hammers. No brass band, no drum beat or shrill note of the fife, but the army moves on—a solid phalanx of twenty-four self-binding reapers—to the music of its own machinery. At one sweep in a twinkling, a swath of one hundred and ninety-two feet has been cut and bound—the reaper tossing the bundles almost disdainfully into the air—each binder doing the work of six men. In all there are 115 self-binding reapers at work. During the harvest about 400 men are employed, and during thrashing 600—their wages being $2 a day with board."

EDISON'S LATEST TELEPHONE.

Some weeks since we described Professor Edison's electro-chemical telephone as it first appeared in practical shape; since then it has passed through a succession of changes until it has finally assumed the compact and convenient form shown in the accompanying engraving. The form, however, is not the only change. In the first electro-chemical telephone, it will be remembered, the chalk cylinder was supplied with moisture by a movable roller which dipped in the exciting fluid and supplied it with moisture. This movable roller is now dispensed with, and the chalk cylinder is inclosed in a vulcanite box, seen at the end of the movable arm. The cylinder, when once moistened, remains in that condition for an indefinite period, as the box is practically airtight.

The small shaft that runs parallel with the iron arm extends through the side of the box and carries the chalk cylinder. Upon the opposite end there is a small pinion moved by a worm, the crank of which is turned by the finger. The diaphragm of the receiving instrument is covered by the front of the box, excepting a small central portion which is quite sufficient for the exit of the sound.

The arm which supports the receiving instrument is jointed so that it may be raised vertically out of the way when the telephone is not in use.

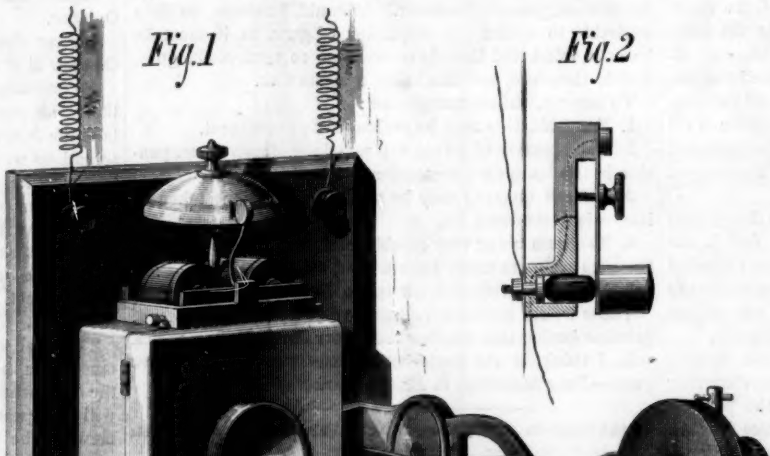
The transmitter is contained in the stationary rectangular box; its mouthpiece projects slightly, and the diaphragm, which is of mica, is supported by a metal frame and springs inside the box cover. This transmitter is quite different from the carbon transmitters now so largely in use in this country, and it will be new to many of our readers; but it is one of Prof. Edison's earliest and best telephones or microphones. It is exceedingly simple and does not require frequent adjustment, while it is equally as sensitive as existing forms of transmitter. The details of its construction will be understood by Fig. 2. A vulcanite arm is secured to the center of the mica diaphragm by means of a small bolt, which is connected with one pole of the battery by a piece of metallic foil or very thin copper wire. The head of this bolt is platinum-faced, and sunk deeply in the vulcanite arm, the same cavity containing also a piece of carbon pencil, such as is used for electric candles. The carbon fits the cavity loosely and is rounded at both ends. Its outer end is pressed by a platinum-faced spring secured to the outer end of the vulcanite arm. The spring carries at its free end, exactly opposite the piece of carbon, a brass weight, and the pressure of the spring upon the carbon is regulated by the small set screw. A wire or piece of copper foil, connecting with the spring, completes an electrical circuit, which includes the primary of an induction coil contained by the rectangular box. The secondary wire of the induction coil is connected with the telephonic line, and a tertiary coil which envelops the secondary is connected with the rubber and chalk cylinder of the receiving instrument. Below the transmitter box are two keys, the right hand one being used for signaling, the left hand one for completing the tertiary circuit when a message is received.

The cylinder of the receiving instrument is made of precipitated chalk solidified by great pressure. The fluid now used to saturate the chalk is a dilute solution of hydrogen disodic phosphate. Professor Edison has found by a long series of experiments that the solution employed must be that of an alkali or the phosphate of an alkali, and the hydrogen disodic phosphate is found to be superior to all others.

The operation of this telephone will be understood by those who are familiar with the first electro-chemical telephone. The vibration of the diaphragm of the transmitting instrument varies the contact between the carbon and the two electrodes, so that a varying current is sent through the primary of the induction coil; this of course produces a secondary current of varying intensity in the secondary wire of the induction coil, which being in circuit with the secondary wire of the induction coil of a distant instrument produces a current in the tertiary wire wound around the secondary coil. The tertiary current passes through the chalk cylinder and the platinum faced rubber, and as the chalk cylinder revolves the friction of the rubber is varied according to the variation of the primary, secondary, and tertiary currents. The platinum faced rubber is connected with the diaphragm, and the friction of the rubber is sufficient, when no current passes, to pull the diaphragm forward as the cylinder is turned; but when the slightest current is sent through the primary coil, the induced tertiary current transforms the frictional surface of the chalk into a frictionless surface and the diaphragm springs back. All this to describe a single vibration of the diaphragm, thousands of which are required for the utterance of a single sentence. It is not essential that the current should be broken to produce the effect in the receiver. It is probable that an absolute break never occurs in the ordinary use of the telephone.

An ordinary call bell is adopted in this system as a means of giving an alarm.

This telephone is unrivaled for loudness of speech, and an electro-magnet is not required in its construction.



EDISON'S NEW TELEPHONE.

MISCELLANEOUS INVENTIONS.

An improved hose coupling has been patented by Mr. Frederick Stewart, of St. Louis, Mo. The object of this invention is to construct hose couplings so that the water passage will be unobstructed and of the full inner diameter of the hose; also, to render the joint of the coupling water tight without using packing rings.

An improvement in electric lamps has been patented by Mr. Norborne B. Gantt, of Louisville, Ky. This invention relates to the construction of the supports for the carbon holders, by which, as the carbon burns away, the carbon holders are automatically adjusted to maintain the electric arc at one point.

An improved shuttle spindle has been patented by Mr. Henry A. Boyington, of Manchester, N. H. The invention consists in shuttle spindles made in two semi-cylindrical parts, placed one above the other, with their flat sides toward each other, having semi-conical heads formed upon their forward ends, having inclined projections or cams formed upon the middle parts of their adjacent sides, and pivoted at their rear ends to the shuttle by two pins, so arranged that the upper pin may be in the rear of the lower one.

Mr. Thomas H. Hicks, of London, Ontario, Canada, has patented an improvement in the class of cylindrical drums or blowers used with carbureters, and which are provided with gudgeons, and rotate in water or other liquid, so that the latter alternately seals and opens the induction and exit orifices for the air or gas passed through the blower or drum. The force of the current of gas flowing to the burners is the motive power which turns the blower or drum on its axis, and the inventor utilizes this force for inducting atmospheric air into a portion of the rotating drum which exactly corresponds in construction to that part of the drum through which the gas passes.

Mr. Orlando Cleaveland, of Middlesex, N. Y., has invented an improved ironing table, which is readily adjustable in height, and may be used for various other purposes than for ironing—for example, as a work, or lunch, or a lamp table.

An improved gate and door closing device has been patented by Mr. William H. Williams, of Mineola, N. Y. This improvement relates to gate and door hangings wherein the gate is closed by a weight. It consists in a novel means by which the weight is shifted to change its purchase and obtain the greatest effect when the gate or door is closed.

Mr. David E. Wilson, of Darlington, Md., has invented an improvement in cattle fasteners, which consists, mainly, of a crank rod or eccentrically pivoted bar, which is arranged close to the inner side of a series of mangers, so that when turned up or revolved a part revolution it will clamp against the manger the ends of the chains or halters which are pendent from the necks or heads of the cattle, and thus secure them. When turned down, it will release all the neck chains or halters at the same time.

An improvement in harness has been patented by Mr. Charles R. Stanhope, of Ashtabula, Ohio. The object of the invention is to furnish an improved means for connecting the belly band or girth and the martingale of a harness, the use of which will allow them to be disconnected without unbuckling the belly band or girth to prevent the horse from being chafed by the martingale interposed between the belly band or girth and his body.

THERE is deposited in the San Francisco Mint a collection of ancient and modern coins valued at $100,000. Among them is a silver shekel of King David's time. This is the oldest coin extant. Another is the Roman penny, with the twins and their foster-mother, the wolf, date 700 B. C.

Poisonous Fishes.

The question of poisoning by eating certain kinds of fishes is one not well understood, and there are several reasons why this is so. Grave and even fatal accidents of this nature have usually occurred in the less civilized portions of the globe; and the phenomenon itself is very complex. There are a large number of suspected species; and in some of these certain individuals alone seem to be possessed of the toxic property, and even in these the danger resulting from using them as food disappears at certain seasons of the year. Finally, ichthyology is such a difficult study that few physicians are well enough acquainted with the subject to accurately determine the genera or species of the poisonous fishes that they meet with in their travels. We translate and condense the following notes on this subject from the *Annales d'Hygiène Publique* :

In the medical report published by the Inspector General of Chinese Customs, residing at Pekin, we find, among the maladies that afflict Europeans living in Japan, that of fish poisoning. The editor of the report, Dr. Stuart Eldridge, states that the salmon is doubtless the most common toxic fish of Japan. From the spring onward this fish is out of season, and if eaten after that period of the year occasions the same accidents as follow the eating of tainted meat. In Japan, the same dangers follow the eating of the *katsuo* (bonita) and the *maguro*, although the sickness they occasion is rarely fatal. A few strange symptoms have been observed, however, such as severe congestion of the brain and face, and nervous derangements difficult of explanation on the theory of the decomposition of the animal matter. In one case the cerebral disturbances were very serious. Several theories have been proposed to explain this remarkable property of the fishes. Some writers believe that it is a morbid element which is developed in the animals at certain seasons. But no such fatal element has as yet been discovered. Others think the idiosyncrasies of the patient have something to do with it. This explanation cannot be accepted; for if there is any idiosyncrasy about it, it exists in the fish and not in the consumer, since it has been proved that certain fishes—the *Lethrinus nambo*, for instance—can be eaten with impunity until it attains a certain size, say a length of 5 to 5½ inches, after which it becomes poisonous. The age of the fish, then, would seem to have something to do with its toxic qualities.

Fishes of very diverse genera have been the occasion of grave and even fatal accidents, and they are found in all parts of the globe, but more especially in the torrid zone. Pappenheim gives a list of more than forty poisonous species. Among these we find mackerels, perches, herrings, sea pikes, and a large number of species belonging to the order *Plectognathes*. The latter order contains five genera that are poisonous. The most common genus of the order in Japan is the *tetrodon* or swell fish, the species of which are all known by the general name of *fugu*, and are considered the most dangerous of the poisonous fishes, so much so, in fact, that their sale at certain seasons is forbidden by law. Dr. Goërtz, of Yokohama, in a memoir read before the German Asiatic Society of Japan, has given a description of the symptoms observed in these cases of poisoning by the *fugu*. One of these was rapidly fatal, the other two were more alarming, but recovered under prompt treatment. At the beginning of the attack there were violent headache and nausea, quickly followed by great muscular weakness; the pulse, the respiration, and temperature all fell at the same instant, thus denoting the very energetic action of the poison upon the nervous centers with special effect upon the pneumogastric. Dr. Houghton, of Savannah (*Lancet*, 1876, page 939), mentions thirteen cases of poisoning by the *Tetrodon hystrix*—one of the Japanese *fugus*—in which the results were identical with those reported by Dr. Goërtz. It is somewhat remarkable that in the three cases given by the latter, and in the thirteen of Dr. Houghton, the subjects are stated to have eaten the eggs of the fish.

Congers, pikes, and barbels have long been recognized in Europe as poisonous at certain seasons, and the eggs of the barbel as especially so.

In Japan the liver of the *fugu*, immediately after the spawning season, is considered the most dangerous part of the fish. A few cases of death caused by eating the liver of the fish have also been reported from the Cape of Good Hope, the poison having proved fatal in some instances in less than seventeen minutes.

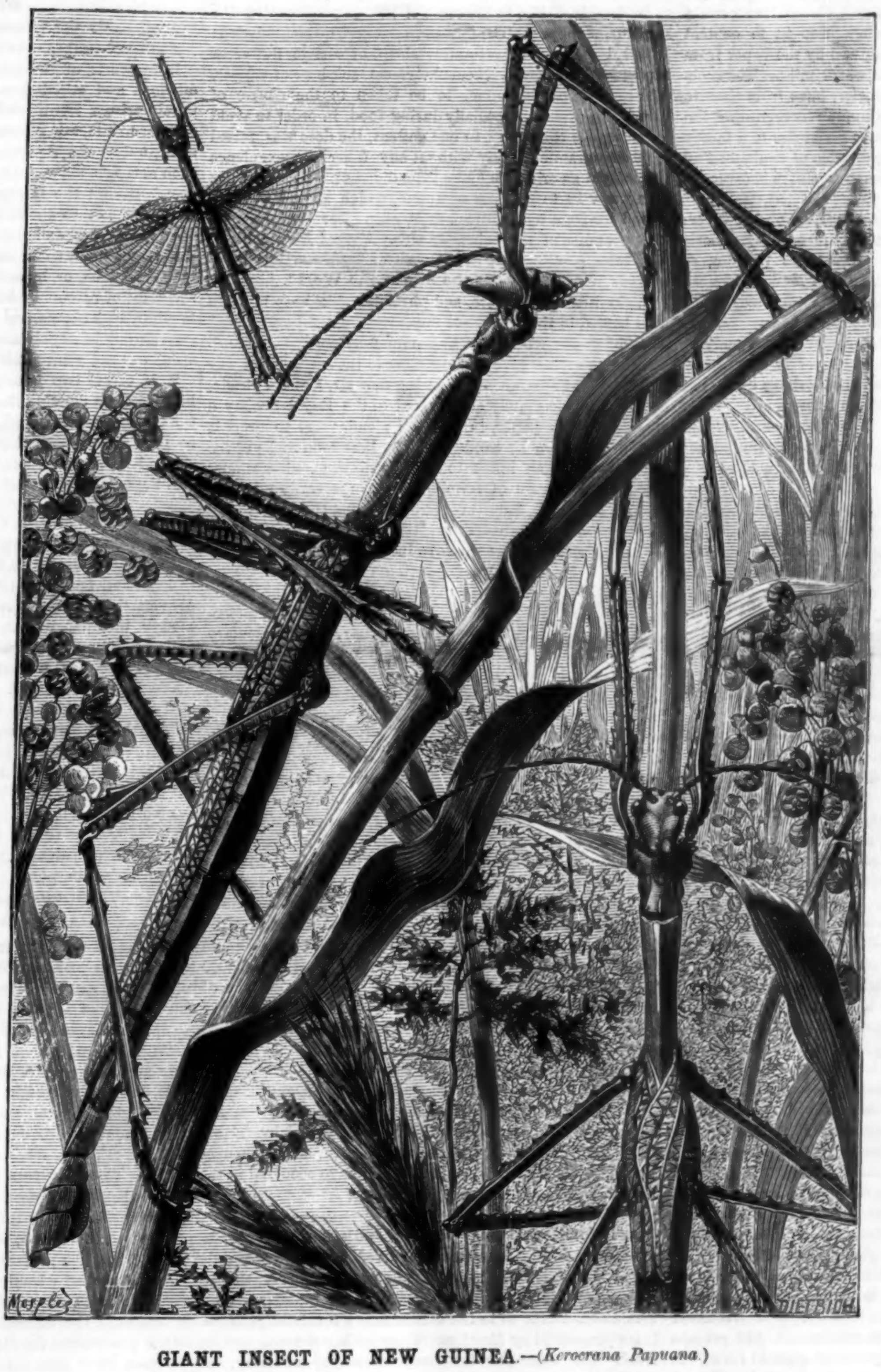
GIANT INSECTS.

The insect shown in the accompanying engraving is of such extraordinary dimensions as to justify the name of "giant among insects." It belongs to the family of *Phasmedæ* (specters), which are distinguished from grasshoppers and crickets by their long slender hind legs, which are adapted for walking and not for leaping.

Many of the phasmedæ are wingless, and when wings exist (in the males) their structure is very peculiar. The wing covers are quite small and useless for protecting the wings, which are broad and ample. The wings are plicated longitudinally in a multitude of folds, the folds being narrower toward the base and increasing regularly toward the edge, so that the wings close like a fan. The wings lie along the body of the insect, and in consequence of their many folds do not break the outline of the stick-shaped body. The outermost fold of the wing is stiff and strong, and when the wing is closed it protects the delicate folds of the wing in the same manner as a fan stick protects a fan.

Some of these insects are as thick as a man's thumb, and fifteen inches long. The color of the insect is green-ish-brown, and may be readily mistaken for the twigs of the shrubs on which it feeds.

The engraving, which we have taken from *La Nature*, is incorrect in one particular, the legs of the insect being somewhat shorter than is natural.



GIANT INSECT OF NEW GUINEA.—(*Kerorana Papuana.*)

Railway Speeds.

The daily express mail train from London to Holyhead makes the distance, 268 miles, in 4½ hours, being at the speed of a little over 59 miles an hour, stoppages included. The distance between New York and Washington is 228 miles, and the fastest train makes it in 6 hours and 20 minutes, or 36 miles an hour, stops included. But most of the trains occupy from 8 to 9 hours.

In this wide country, where railway engineering exhibits such great triumphs, it would seem as if we ought to be able to run trains between our important cities as fast as the Britishers do. If we had a Holyhead express between New York and Washington, the time of transit would be reduced nearly one half, to wit, to 3 hours 40 minutes. This would enable passengers to leave New York in the morning, have an entire official day for business before the departments in Washington, or attend a session of Congress, and still be home again in time for the evening tea.

Ailantus Wood.

Persons who know the ailantus only as a shade tree, with its nauseous blossoms and uncouth growth, will be glad to learn that it possesses invaluable qualities of strength, durability, beauty of finish and color for carpentry and cabinet work, freedom from warping and shrinkage, ease of being worked without injury to tools and with little or no waste. It is a rapid growing tree, as all know, upon poor soils as well as good ones, in exposed situations on the sea coast, and in the interior. It seasons readily, and when dry is free from the unpleasant odor which characterizes the wood when green. It has a higher value as fuel than most of the wood in general use. Experiments made in the French dockyard at Toulon showed that the ailantus broke with a weight of 72,186 lb. where the elm yielded to a weight of 54,707 lb., and the oak to a weight of 43,434 lb. The small second growth is said to make very durable grape stakes, to which it seems well adapted. A set of furniture, made of this wood, has been in use in Providence, R. I., for about twenty years. It takes a high polish, and may be cut so as to present a satin luster which is very pleasing. It is regarded by some cabinet-makers as equal to mahogany and superior to black walnut in the matter of shrinking. For the treads of stairs, for floors of offices, mills, and other buildings, where a hard, strong wood is required, it is regarded by many as superior to most of the woods thus employed. Its warm color makes it an effective finish when used with both lighter and darker woods, and as wainscoting is again becoming fashionable, the ease of producing this wood where other woods are not readily obtainable, will recommend this style of interior finish. The tree grows more rapidly when young than when it has attained considerable age.

Chloral in Whooping Cough.

Dr. C. H. Smith reports that in two hundred cases of this disease treated with chloral, he has in every case noticed a marked alleviation of the symptoms and shortening of the period of the disease. Only one case lasted seven weeks, and the majority of the cases were well in from two to six weeks. No other remedy was given.—*N. Y. Medical Journal.*

Hay Fever.

At the present time there are probably nearly 50,000 people suffering from what is called hay fever.

When this affection was first recognized it was supposed that it depended upon the irritation produced by the pollen of certain flowers and grasses which floated in the air in the months of May, June, July, and August of each year.

Subsequently is was claimed that two distinct forms of the disease existed, and to one was given the name of "June cold," while the other received the name "autumnal catarrh."

Further observation revealed the fact that an affection characterized by symptoms essentially the same as those seen in connection with hay asthma, hay fever, June cold, rose cold, autumnal catarrh, etc., occurred in seasons of the year in which none of the supposed exciting causes of the hay fever could operate, and for some time the reasoning was that it must be some other disease than that produced by the pollen of plants. It was also observed that certain persons were peculiarly affected when brought in contact with certain animals, such as the cat, and by the vapor from certain animal substances, such as warm milk. These observations, and others of like character, have from time to time led to modifications of former opinions regarding the nature of hay fever, and, at last, have given rise to a theory which has been promulgated as one capable of explaining all the phenomena of the disease whenever and wherever occurring.

In this country two books have been written on hay fever: one—the oldest, and for a long time the only systematic monograph upon the subject—by Dr. Jeffries Wyman, of Boston; the other by Dr. Geo. M. Beard, of New York. In Dr. Beard's book we find the first open announcement of the theory to which we have already referred, namely, the "nerve theory." This theory is the result of the study of one hundred cases, and it is that hay fever is a neurosis. According to this theory, the disease is subjective instead of objective; external irritants, which are exceedingly numerous, such as rag weed pollen, etc., are of a secondary and a tertiary character and powerless in themselves to produce the disease, and produce the disease only when acting on a nervous idiosyncrasy.

This author has described a new form of the disease, which he calls the July cold, or middle form, which links the early form, or June cold, with the later form, or autumnal catarrh. It seems to us that the nerve theory explains many of the cases which have heretofore been regarded as very obscure; for example, those in which the symptoms peculiar to hay fever have continued from May to November, or during the winter months, or all the year round. If the nerve theory be true—and it seems to be fairly sustained—it revolutionizes the treatment of the disease. It must be attacked from a new point of view; yet it cannot be successfully claimed that all cases are to be treated alike, or that any specific can be found for it. The remedies to be employed are those which are not painful—not even disagreeable. Of course, removal from the exciting cause is the primary factor in obtaining prompt relief; but, when this cannot be effected, the symptoms can be greatly relieved, and many cases cured, by such remedies as arsenic, nux vomica, carbolic acid, belladonna, tonics and sedatives, electricity, etc., and their combinations:—*Medical Record.*

Typhoid Fever from Diseased Meat.

An epidemic of typhoid fever, interesting in its etiology, followed a musical festival at Zurich, in May, 1878. Out of some 700 assistants, 500 were attacked by the disease, of whom 100 died. The symptoms could not be mistaken, and the autopsies confirmed the diagnosis. A minute inquiry into the circumstances left but little doubt that the epidemic was due to the use of bad veal furnished by an innkeeper of the place. It may be claimed by those who attribute to general causes the power of originating specific diseases, that the typhoid fever was due to a septic poison present in the veal, depending possibly on a beginning fermentation, which was not destroyed by the cooking to which it had been submitted. On the other hand, as the animal from which the meat was taken was sick, it may be asked whether it might not have been suffering from typhoid fever, although this disease has never yet been recognized among animals. It is a remarkable fact that in 1839 a similar but much less fatal epidemic occurred in a neighboring locality. After a reunion that took place under similar circumstances, 440 persons were taken sick with all the symptoms of typhoid fever. It is probable that in this case also the meat of a sick calf gave rise to the disease.—*Journal de Médecine.*

Ammoniacal Sulphate of Copper in Neuralgia.

Dr. Féréol having found several times obstinate cases of neuralgia of the fifth nerve, tic-douloureux, which had resisted a variety of other means, rapidly and completely cured by the administration of ammoniacal sulphate of copper, reports to the Académie de Médecine on the subject (*La France Médicale*, April 5th). The first case is that of a strong man, aged thirty-two, who had suffered so atrociously from terrible neuralgic crisis that on some days he was scarcely free for a few minutes at a time. Six teeth had been vainly extracted, and anti-neuralgic medication exhausted. He then tried ammoniacal sulphate of copper. The amelioration was considerable on the first day; on the second, the patient slept all night for the first time in two months; and at the end of ten days he left the hospital cured. A second case of supra-orbital neuralgia in a strong young man, occurring every morning and ceasing at noon, had been vainly treated by leeching, blistering, and full doses of quinine. The ammoniacal sulphate of copper, given in a dose first of all of 0·10 and then 0·15 centigramme daily, produced an immediate amelioration of pain, and the patient described himself as cured. The medication was continued for a week, and the neuralgia did not return. Similar effects were obtained by M. Féréol in a lady, aged forty-three, delicate, nervous, but not hysterical, suffering from persistent right hemicrania, with atrocious pain in the fifth pair of nerves, which drove her almost wild, and for which she had vainly tried quinine, aconite, morphia, hypodermic injections, etc. Similar results were obtained in an old man, aged sixty, suffering for eighteen months from a horribly painful neuralgia, starting from the nasal branch of the fifth, and in whom local and general treatment by the oldest of anodynes and antiperiodics had been vainly tried. In this case the results were not permanent, the patient having an invincible dislike to the sense of nausea produced by the sulphate of copper. The formula employed is the following: Distilled water, 100 grammes; sirup of orange flower or peppermint, 30 grammes; ammoniacal sulphate of copper, 0·10 to 0·15 centigramme, to be taken in the course of twenty-four hours, especially during food, in order to avoid irritating the stomach. In one patient, the dose was raised to 60 centigrammes a day without any other inconvenience than slight gastric pain and a little diarrhea. The medium dose was 0·10 to 0·15 centigramme, which should be continued for from ten to fifteen days, even after the complete disappearance of the pains.—*London Medical Record.*

Late Views of the Age of the World.

Geologists, astronomers, and physicists alike have hitherto been baffled in their attempts to set up any satisfactory kind of chronometer which will approximately measure geological time, and thus give us some clew to the antiquity of our globe. It is therefore worth noting that Mr. Mellard Reade, of Liverpool, has lately contributed to the Royal Society a very suggestive paper, in which he endeavors to grapple with the question by employing the limestone rocks of the earth's crust as an index to geological time. Limestones have been in course of formation from the earliest known geological periods, but it would appear that the later found strata are more calcareous than the earlier, and that there has been a gradually progressive increase of calcareous matter. The very extensive deposition of carbonate of lime over wide areas of the ocean bottom at the present day is sufficiently attested by the recent soundings of the Challenger. According to the author's estimate, the sedimentary crust of the earth is at least one mile in average actual thickness, of which probably one-tenth consists of calcareous matter. In seeking the origin of this calcareous matter, it is assumed that the primitive rocks of the original crust were of the nature of granite or basaltic rocks. By the disintegration of such rocks, calcareous and other sedimentary deposits have been formed. The amount of lime salts in water which drain districts made up of granites and basalts is found, by a comparison of analyses, to be on an average about 3·73 parts in 100,000 parts of water. It is further assumed that the excessed areas of igneous rocks, taking an average throughout all geological time, will bear to the exposures of sedimentary rocks a ratio of about one to nine. From these and other data, Mr. Reade concludes that the elimination of the calcareous matter now found in all the sedimentary strata must have occupied at least 600,000,000 of years. This, therefore, represents the minimum age of the world. The author infers that the formation of the Laurentian, Cambrian, and Silurian strata must have occupied about 200,000,000 of years; the Old Red Sandstone, the Carboniferous, and the Poikilitic systems, another 200,000,000; and all the other strata, the remaining 200,000,000. Mr. Reade is, therefore, led to believe that geological time has been enormously in excess of the limits urged by certain physicists; that it has been ample to allow for all the changes which, on the hypothesis of evolution, have occurred in the organic world.—*London (Eng.) Academy.*

Engraving of Copper Rollers with Chromic Acid.

Copper printing rollers are engraved in two ways, only one of which is actually engraving proper, namely, the impression of the pattern by means of a steel die, a process which sometimes, as in the case of heavy furniture patterns, is supplemented by direct engraving with a graving tool by hand. The other plan frequently employed is etching, the substance of the copper being eaten away by the application of acids. This process gives very nice shading, and when judiciously employed is of much use.

Generally this method consists in covering the roller with a mastic or varnish, which protects the places which are not to be acted upon, and which leaves the pattern to be engraved open. The roller thus prepared is then plunged into a bath of nitric acid of 15° B., or stronger. Sometimes a little hydrochloric acid is added to favor the dissolving action of the acid. The operation generally takes not more than five or six minutes.

This process has grave inconveniences, especially in places where there is not a sufficiently strong ventilation to immediately carry off the fumes which are formed in large quantities. This free acid is not only dangerous for the workpeople, but, spreading in the room, soon affects the machines. There is also this drawback, that the acid acts underneath the varnish, resulting in unclean edges of the engraving.

A German chemist has for some time employed chromic acid in place of nitric acid, and from all accounts with very satisfactory results, especially in damp localities. The attack of this acid upon the metal is a little slower, but the engraving is sharper and clearer. The solution is the following: 5 oz. of commercial bichromate of potash are dissolved in 26 oz. hot water, after which 12 oz. sulphuric acid of 66° B. are carefully added, and the whole well mixed.

This bath gets brown by usage; if after a few days' use it becomes much so it must be thrown away. It is necessary, in order to obtain good results, to slightly heat the bath, which is done by placing the trough containing it into a bath of tepid water (?).

The cost of working with chromic acid is even cheaper than with nitric, and altogether it appears to have many qualities to recommend it to calico printers.

RECENT DECISIONS RELATING TO PATENTS, TRADE MARKS, ETC.

By the Commissioner of Patents.

GRAIN DRILLS.—BERLEW *vs.* BERLEW & SMITH.

1. In courts of law judgment may be rendered upon admissions and stipulations of parties to actions involving purely private rights, and acts whereby one party induces another to adopt a course which would result in his detriment, unless the representations and promises involved in such acts are made good, present safe grounds for judicial decisions; but the law grants patents to first and original inventors, not to those who are conceded or admitted by others to be first and original inventors in the face of proof that they are not such; and parties cannot, by admissions or by concessions, or by acts constituting estoppels, determine the grant of patents in defiance of the facts. Subject to the modifications necessarily resulting from these differences in the subjects of adjudication, the rules of equitable estoppel apply in the Patent Office as in the courts.

2. If one or two joint applicants could by his acts estop himself from denying that the other was a joint inventor, the Commissioner would not by such an estoppel be authorized to declare the other a joint inventor when the facts showed that he was not; but he might be authorized to protect the other from fraud by making him a joint patentee.

By the Acting Commissioner of Patents.

BAG FASTENER.—MCKENNA *vs.* REDDEN.

1. The applicant who conceived the idea of an invention in 1869, and from that time forward until 1876 simply had conversations about it and made one or two experimental models, then patented an invention of the same class, but of entirely different construction, held not to be the first and original inventor as against another who, although subsequent to conceive, had patented the invention in controversy, and put the same in extensive public practice a year before the former applicant had filed his application for a patent for the same invention.

2. It is a well settled doctrine that an inventor of a device must not only be the *first* inventor, but that he must also exercise diligence in reducing the same to practice in order to invalidate the title of a patentee, or to obtain a patent as against such a patentee, who, although subsequent to invent, was diligent in putting the invention before the public, while the one first to devise was making no effort to that end.

GLASS PATTERNS.—EX PARTE REES.

1. A mere change of material in the construction of a machine or an article, where the superiority attained is due alone to the nature of the material employed, unaccompanied by changes of adaptation, or useful results not before contemplated, is not invention.

2. A pattern made of glass, from which the vamps, quarters, and other parts of boots, shoes, etc., are cut, held patentable, in view of certain new and valuable results attained, notwithstanding the fact that such patterns had heretofore been made from paper, iron, brass-bound boards, etc.

A Caution about Shot in Game.

This being the season when game killed by shooting, and probably containing the pellets, is eaten, it may be worth while to caution those who consume the flesh of birds with avidity that the proportion of instances in which shot is found is probably small in comparison with the number of cases in which the pellets are unwittingly swallowed. It is a matter of speculation how much mischief a shot may do when passed into the intestines, but the fact that anomalous diseases have been set up by the presence of very small bodies which have become entangled in folds of the mucous membrane renders it desirable to put the public on their guard. Occasionally the most disastrous results have followed such small causes.

We have in recollection the case of a physician who died after prolonged and unexplained sufferings, from the impaction of a very small nail which had found its way into a pudding, and was inadvertently swallowed. A little care will avoid this contingency, but, remembering that the bird had been shot, some pains ought certainly to be taken to avoid swallowing the missile.—*Lancet.*

STEEL.—The production of steel effected by Great Britain last year was 807,527 tons. In the same year the United States made 732,226 tons of steel; Germany, 240,000 tons; France, 140,000 tons; Belgium, 75,000 tons; Sweden, 20,000 tons; and Austria, 25,000 tons. The aggregate steel production of the world was thus something over 2,000,000 tons last year.

Glass Railway Sleepers.

A new and somewhat singular material for railway and tramway sleepers has lately been introduced into England, this material being glass toughened by a process discovered by Mr. Frederick Siemens, of Dresden. Owing to Mr. Siemens' patents for the most recent improvements in his process not yet being completely secured, we must postpone for the present any details of the toughening process itself, but we may state that its effect appears to be to secure a product differing essentially from glass toughened by the well known process of M. De la Bastie, inasmuch as when broken it does not fly to pieces like glass treated by the last mentioned process, but merely fractures somewhat like cast iron.

The material used by Mr. Siemens for his sleepers is glass of the commonest kind moulded to any desired form. The sleepers are being introduced into this country by Mr. Hamilton Lindsay Bucknall, who has lately laid some of them on the line of the North Metropolitan Tramways at High street, Stratford. The sleepers in this case are of exactly the same section as the wooden longitudinal sleepers they have replaced, namely rectangular, 4 inches wide by 6 inches deep, the upper side being moulded so as to accurately fit the rails. They are laid in lengths of 3 feet, and to avoid the danger of settlement at the joints, bearing plates, 10 inches by 5 inches by 1½ inch, are placed at these points, these plates being also utilized for effecting the securing of the rails by a fastening which obviates the necessity of moulding any hole in the glass. We may add that samples of the sleepers above mentioned have been tested by Mr. Kircaldy, and their average breaking weight when resting on supports 30 inches apart has been found to be about five tons, this being probably about two thirds of the resistance which would be afforded by a good pine sleeper of similar dimensions. It must, however, be borne in mind that, whereas the timber would become depreciated by use, the glass promises to be practically indestructible by moisture, etc.

At the works of Mr. William Henderson, a plate of Mr. Siemens' toughened glass, 9 inches square by 1½ inch thick, embedded in gravel ballast 9 inches deep, and having on its top a wood packing ½ inch thick, and a piece of rail, was subjected to the action of a falling weight, the blows being delivered on the rail. The weight was 9 cwt., and blows were successively delivered by letting this weight fall from heights of 3 feet, 5 feet 6 inches, 7 feet, 10 feet, 12 feet 6 inches, 15 feet, 17 feet 6 inches, and 20 feet. Under the last mentioned blow the rail broke, the glass, however, being uninjured. As a higher fall could not be obtained, and a greater weight was not available, a smaller section of rail was substituted for that previously employed, and the glass was broken by a second blow of the 9 cwt. falling 20 feet, the plate being driven through the ballast into the hard ground. A cast iron plate, 9 inches square and ½ inch thick, tested in a similar way, broke with a blow from the 9 cwt. weight dropped 10 feet.

The cost of the toughened glass is stated to be about the same per ton as that of cast iron, but as its specific gravity is only about one third that of iron, the cost of any article of given dimensions is of course materially less. The material has as yet been too recently introduced, and too little is known of its characteristics, to enable any very decided opinion to be formed as to its future capabilities; but the results of the experiments so far made with the material are certainly of an exceedingly promising character, and the further development of its application will be watched with much interest.—*Engineering.*

Refrigerated Storehouses.

A large six story building, belonging to the Massachusetts Chemical Refrigerating Company, located on North street, Boston, has been fitted up with machinery for generating and distributing cold air, and compartments for the storage of provisions. Ammonia is employed as a chemical agent to produce cold air, the same as is used in the ice-making machines of the South. After the storehouse has been rendered as nearly as possible impervious to outside atmospheric changes, the heat and gases are drawn off from the interior by a powerful exhaust fan, condensed, purified, and returned to do the work of refrigeration. By this continuous process the air is undergoing constant renovation, and is pure, cold, and dry to an extent not attained by other methods of refrigeration. The building referred to contains 94,000 cubic feet, of which 80,000 feet are now occupied by no less than 10,000 packages of butter, 300 barrels of beef, 650 cases of pork, 3,500 dozen eggs, 7,800 lb. evaporated apples, and about two tons of cheese, the property of different produce and commission houses. Similar refrigerators may be soon erected at several mercantile centers, and a line of steamers be fitted up to connect with trains of cars which shall all be similarly furnished.—*American Manufacturer and Exporter.*

Moral and Mental Effects Produced by Foods.

Dr. Bock, of Leipsic, writes on the effect of food and drink:

"Beer is brutalizing, wine impassions, whisky infuriates, but eventually unmans. Alcoholic drinks, combined with a flesh and fat diet, totally subjugate the moral man, unless their influence be counteracted by violent exercise. But with sedentary habits they produce those unhappy flesh sponges which may be studied in metropolitan bachelor halls, but better yet in wealthy convents. The soul that may still linger in a fat Austrian abbot is functional to his body only as salt is to pork—in preventing imminent putrefaction."

FIRE SCREEN.

The accompanying illustration represents a charming piece of work designed and executed under the auspices of the Royal School of Art Needlework, in London. The design was doubtless made by one of the artists employed by that institution, after which it was embroidered upon the cloth and mounted as we see it here. A fourth panel, concealed from view in the illustration, but similar in character to the one on the right, completes the harmony of the design, which is in every way admirable.

FIRE SCREEN—ROYAL SCHOOL OF ART NEEDLEWORK.

Terrestrial Magnetism and Electricity.

Professors Ayrton and Perry, of the College of Engineering, Tokio, Japan, communicate to the *Philosophical Magazine* a short note, proposing the hypothesis that the phenomena of earth currents, terrestrial magnetism, and atmospheric electricity are due to the fact that the earth is an electrified condenser, whose capacity or potential is continually changing on account of its rotation and its annual orbital motion, the successive cooling and warming of the air, the formation of clouds and rain, etc., etc. These changes produce electric currents tending always to restore the equilibrium, whence follow the phenomena in question. They suggest that observations of atmospheric electricity may be used to predict atmospheric changes.

William Leroy Broun describes, in *Nature*, a new lecture experiment, to show the action of terrestrial magnetism. A rectangular frame of light wood, carrying twenty coils of insulated wire, was suspended in a horizontal position from the pans of a balance, so that the long sides of the rectangle were at right angles to the beam; and mercury connections were arranged at the middle of the short sides, so that a current could be sent through the wire. This apparatus being placed with the long sides of the rectangle perpendicular to the magnetic meridian, when the battery current passed from east to west on the northern side, and from west to east on the southern side, the north side would be attracted, and the south side repelled by the earth currents, both influences combining to deflect the beam of the balance. On reversing the current the deflection was in the opposite direction.

The Simplon Tunnel.

Our French neighbors, recognizing the vast importance of the proposed Simplon tunnel to their commerce, have, during the last few months, been in negotiation with the Swiss Government, and a treaty similar to the one which was concluded in 1871 between Germany, Switzerland, and Italy concerning the St. Gothard tunnel, will shortly be signed, by which permission will be granted to the French Government to subsidize the Simplon Railway Company to the amount of some 48,000,000 francs. M. Léon Say, the French Minister of Finance, arrived at Vevay on August 16 to make a personal inspection of the site of the tunnel and of the works which have already been carried out, in order that he may possess full *connaissance de cause* in recommending his government to grant the subsidy in question. The works alluded to consist of a line of railway lately completed and opened to traffic, which extends from Lausanne up the Rhone Valley to Brigue, at the foot of the Simplon—the very spot where it is proposed to pierce the tunnel.

On the other side of the mountain the Italian Government is engaged in constructing, at the cost of 28,000,000 francs, a line of railway which will unite Iselle at the southern end of the tunnel with Arona on the Lake Maggiore, the present northern terminus of the Haute Italie railways. The Simplon Railway Company are now, therefore, about to commence the tunnel, which, when terminated, will complete the straight line of railway extending from Paris to Brindisi, *via* Pontarlier, Lausanne, the Simplon, and Milan, thus obviating the immense angle described by the Mont Cenis route. It may be remembered that the proposal to subsidize the Simplon route was already submitted to the French Chambers in 1873, when it was indefinitely postponed without discussion. This want of proper consideration must be attributed to several reasons. In the first place, the resignation of M. Thiers and other political events absorbed men's minds in France at that moment; secondly, the Compagnie de la Ligne d'Italie, in whose favor the concession had originally been granted, had just failed in an exceedingly discreditable manner, and had been wound up by order of the Swiss Government. Lastly, at that time, when the prospect of completing the St. Gothard tunnel was apparently hopeless, the Simplon route not only seemed to offer no very special advantages to French commerce, but even appeared in the light of a competitor with the Corniche and Mont Cenis Railways, nor were the Paris-Lyon-Mediterranée Railway Company in favor of the undertaking. Now, however, the aspect of affairs has entirely changed. Since 1874 a new company has been intrusted with the execution of the enterprise, and has given most satisfactory proofs of its activity by the completion of the railway up to the very entrance of the proposed tunnel at Brigue. Colonel Cérésole, formerly president of the Swiss Confederation, is the leading spirit and managing director of this company, and is encouraged in his work by the earnest support of such men as Gambetta, Grévy, Léon Say, etc.

Although the tunnel will be rather longer than that of the Mont Cenis or of the St. Gothard, it will be constructed and worked under very much more favorable conditions than either of them. The entrances to the St. Gothard and Mont Cenis tunnels are both situated at a considerable altitude—the former being at 1,152 meters, and the latter at 1,560 meters above the level of the sea. Consequently, costly zigzag and corkscrew lines of access have been resorted to in order to reach the entrance of the tunnels, and owing to the very steep gradients, the power of traction required is something enormous. The Simplon tunnel, on the other hand, enters the mountain at its very base. The railway extending from Lausanne up the lower part of the Rhone Valley, is perfectly straight and without any curves, while the gradient nowhere exceeds 10 millimeters—1 in 100. At its exit on the southern side of the mountain, in the Diviera

Valley, the gradient is somewhat stronger—13 in 100. In fact, when the tunnel is completed, the highest point of the line between Paris and Milan will not be in the Simplon, but between Dijon and Lausanne. Owing to the low level of the tunnel, the line will not suffer from the frequent interruptions which the snow causes in winter on the Mont Cenis and St. Gothard routes.

Competent geologists declare that the granite and rock of the Simplon are less hard and compact, and that the infiltrations are less serious than those of the St. Gothard and the Mont Cenis. The Rhone at the Swiss, and the Diviera at the Italian extremity of the tunnel, will provide the hydraulic power necessary for the boring, while, thanks to the temperate climate of the Valais, the works will not be exposed to the risk of being deprived of their motive power during severe winters, as were those of the Mont Cenis and the St. Gothard.

The tunnel will be 18½ kilometers in length, as compared with the 15 kilometers of the St. Gothard and the 12 kilometers of the Mont Cenis tunnels; and, as it is estimated that a daily advance will be made of 9 to 10 meters in the boring, we may look for its completion in seven or even six years' time. Eighty million francs are to be devoted to the undertaking under the following items: 74,000,000 francs for the tunnel itself, estimated at the rate of 4,000,000 francs per kilometer. This estimate appears somewhat high when compared with that of the St. Gothard, which is being pierced at the rate of 2,500,000 francs per kilometer. One million francs are required for the completion of the roadway in the tunnel, and 5,000,000 francs for the construction of a great international station at Brigue, similar to that at Modane, on the Mont Cenis Railway.

Only a very small portion of this sum, namely 13,500,000 francs, consists of stock subscriptions, the balance of 66,500,000 francs being granted to the company in the form of the following subsidies: 4,500,000 francs from the Swiss Federal Government; 5,000,000 from the government of the Canton de Vaud; 1,000,000 from the government of the Canton du Valais; 3,000,000 from the governments of the Cantons de Berne, Fribourg, and Geneva; a grant of 5,000,000 from the Swiss Occidental Railway Company, which will derive great advantages from the undertaking; and, lastly, 48,000,000 francs, the subsidy about to be granted by France.—*London Times.*

Argan Oil.

Except the description given by Sir Joseph Hooker in his recent Book of Travels in North Africa (see SCIENTIFIC AMERICAN, April 12, 1879), and a brief notice of the exportation into Europe of argan oil by the Danish Counsellor of State, Georges Höst, who traveled in the kingdoms of Marocco and Fez during the years 1766–1768, the only published account of the uses of the argan is given in a very little known Danish work, published by P. K. A. Schousboe, entitled "Iagttagelser over Vœxtriget i Marokko." Forste Stycke. Kiobnhavn, 1800, 4, 7 tab., of which a German edition appeared in 1801, in 8vo, by J. A. Markussen. It gives an account of some Marocco plants; and, after an introductory sketch of the physical geography of Marocco, it contains descriptions of the plants of the country in Latin and German, with occasional observations in German. The account of the argan under Retz's name of *Elæodendron argan* is long: first comes a technical description, followed by a history of its synonymy, and then the following notes (translated for the *Gardener's Chronicle*, by Mr. Bentham):

"It is surprising that this tree should hitherto have been so little known, as it is found in a country near Europe, and visited by many travelers, who speak in their diaries and descriptions of oil of argan and of argan trees, these last as constituting a considerable proportion of the forests of the country. It is, however, not to be met with in the northern provinces, but only toward the south. All those persons from whom I have sought more accurate information on the subject are unanimous in stating that it only grows between the rivers Tansif and Sus—that is, between the 29° and 32° N. lat.—and there constitutes forests of considerable extent. It flowers in the middle of June, and the fruit remains on the tree the greater part of the year. The young fruit sets in the end of July or beginning of August, and grows slowly till the rainy season commences toward the end of September. It now enlarges rapidly and attains its full size during that season, so as that by the middle or end of March it is ripe enough to be gathered for economical uses. Both the fruit and the wood are serviceable, but especially the former; for from the kernel an oil is extracted which is much employed for domestic purposes by the Moors, and is an important production of the country, as it saves much olive oil, which can thus be thrown into commerce and made to bring money into the country. It is calculated that in the whole argan region 1,000 cwt. of oil is annually consumed, thus setting free an equal quantity of olive oil for exportation to Europe. Our countryman, Höst, in his 'Efterretninger om Marokos,' p. 285, says that the argan oil is exported to Europe, where it is used in manufactures. Such may have been the case in former times when it might be cheaper; but now there would be no advantage in doing so, as it costs almost as much as olive oil. At present no argan oil whatever is exported.

"As the practice in preparing this oil is somewhat different from that of common olive oil, it may be useful to enter into some details on the subject. I have myself been present during the whole operation, and consequently speak from experience:

"In the end of March the countryman goes into the wood, where the fruits are shaken down from the trees and stripped of their husks on the spot. The green, fleshy pericarp, which is good for nothing else, is greedily eaten by ruminating animals, such as camels, goats, sheep, and cows, but especially by the first two. Therefore, when the Arab goes into the wood to collect argan nuts, he gladly takes with him his herds of the above animals, that they may eat their fill of the green husks whilst he and his family are collecting and shelling the nuts. The horse, the ass, and the mule, on the contrary, do not like this food. When a sufficient quantity of nuts are collected they are brought home, the hard wooden shell is cracked between stones, and the inner white kernels are carefully extracted. These are roasted or burnt like coffee on earthen, stone, or iron plates; in order that they may not be too much done they are constantly stirred with a stick. When properly roasted they should be all over of a brown color, but not charred on the outside. The smoke which is disengaged during the process has a very agreeable odor. As soon as the kernels have cooled, they are ground in a handmill into a thick meal, not unlike that of pounded almonds, only that it is of a brown color, and the meal is put into a vessel in which the oil is separated, which is done by sprinkling the mass now and then with hot water, and keeping it constantly stirred and kneaded with the hand. This process is carried on until the mass becomes so hard that it can no longer be kneaded; the harder and firmer are the residuary coarse parts, the more completely is the oil extracted. At the last, cold water is sprinkled upon it, in order, as they say, to expel the last particles of the oil. During the operation the oil runs out at the sides, and is from time to time poured into a clean vessel. The main point to be attended to in order to extract the greatest quantity and the best quality of oil, is that it should be well kneaded, and that the proper proportion of hot water for the extraction of the oil should be used; it is always safer to be sparing of it than to be too profuse. The residuary mass, often as hard as a stone, is of a black-brown color, and has a disagreeable, bitter flavor. The oil itself, when it has settled, is clear, of a light brown color, and has a rancid smell and flavor. When it is used without other preparations in cooking, it has a stimulating and pungent taste which is long felt on the gums. The vapor which arises when anything is fried in it affects the lungs and occasions coughing. The common people use it generally without preparation, but in better houses it is the custom, in order to take off that pungency, to mix it previously with water, or to put a bit of bread into it and let it simmer before the fire. "The wood, which is hard, tough, fine-grained, and of a yellow color, is used in house carpentry and for other purposes."

American Jute.—(*Arbutilon Avicennæ.*)

In a communication to the *Ohio Farmer*, the Secretary of the New Jersey Bureau of Statistics of Labor and Industry confirms the high opinion that has been expressed with regard to the utility of the common arbutilon as a fiber plant. Hitherto this plant has been a common weed—too often a common nuisance—throughout the Middle States. For half a century or so it has had a hard fight with our farmers, whose efforts to eradicate it have been unavailing.

Having thus proved its right to grow, by inherent vitality and stubbornness, the arbutilon is now promoted from the order of weeds to the ranks of the useful plants, thus demonstrating anew Emerson's dictum that a weed is only a plant whose utility has not been found out. The Secretary, Mr. Sam'l C. Brown, says:

We need anticipate no difficulty in growing this jute-producing plant upon any good, well fertilized upland, or well drained bottom lands, but we always state that our success in producing the fiber, owing to the cheap labor of India, is wholly dependent upon obtaining it through mechanical appliances. This problem I regard as well nigh solved already. If not by contrivances now in hand, through modifications or substitution of others, success will be achieved sooner or later. The inventive genius of our country is not exhausted, but more alert and aggressive than ever.

The quality of this domestic jute, for a diversity of purposes, is established beyond question. Hitherto gunny cloths, cordage, and other coarse products have absorbed most of the jute manufactured in India, England, and in this country, but Mr. Lafranc, who is an expert in fibers, and giving special attention to the development of jute and ramie in New Jersey, thinks we will be able to turn jute to other and more profitable uses, in combination with wool, cotton, silk, etc. This will be effected by cottonizing the long staple, thus making a vegetable wool which in fineness and strength will be in close proximity to the coarser grades of animal wool. Samples of jute, thus manipulated into a higher priced commodity, have been submitted to carpet manufacturers and other consumers of coarse wool, and they have elicited unqualified approval for the purposes indicated.

The range of uses to which jute in its various forms can be utilized under a system of cheap production, is without limit, so that instead of consuming for domestic purposes, as we now do, about five million dollars per annum of raw and manufactured jute, the quantity could be increased many fold, and our agricultural and manufacturing interests be vastly augmented thereby. Any one who has seen spontaneous patches of the arbutilon growing under ordinarily favorable conditions, can see that the product of a cultivated field per acre would necessarily be heavy, for its growth is often eight feet, and we have seen it twelve feet high. Our calculation, based upon observation of wild and cultivated growths, is that with appropriate fertilizers and rich soil, from four to seven tons of dry stalks can be grown per acre. Mr. Lafranc offers to pay, this fall, eight dollars per ton for jute stalks, and ten dollars for ramie, delivered in Camden in a dry state. All these are proximate figures, and are furnished to meet a natural inquiry respecting the profit of growth to the farmers. We always take occasion to advise the farmers to collect all the seed within their reach for future use. It is generally believed that the best results will be obtained in jute culture from sowing the seed broadcast, and in soil as free from weeds and grass as possible.

A New Theory of Sea Sickness.

The singular benefit derived by the use of amyl nitrite in sea sickness has suggested a new theory of the cause of that distressing malady, namely, that it is due to cerebral anæmia. The proposer, Henry Naylor, L.R.C.P., L.R.C.S., Edinburgh, says:

"The rapid swinging of the vessel and the body with it irritates the eyes and vision, and this by reflex action produces a spasm of the cerebral capillaries; this explains the feeling of faintness and giddiness that comes on suddenly, just as the vessel gives a big swing. The sudden emptying of the cerebral vessels causes the stomach to sympathize, resulting in efforts of vomiting, whether the stomach be full or empty. These symptoms are most distressing when the subject is in a standing or sitting position, with the eyes open. If he lies down the change of position relieves the anæmia, the faintness and giddiness pass off, and the sickness ceases. But occasionally even the recumbent position does not give relief if the eyes are kept open. When they are shut the symptoms are not felt in the least. I have known this to be the case with several ladies who were never comfortable while at sea unless they were lying down with their eyes closed. They were able to eat meals and retain them if they lay down and closed their eyes immediately afterwards. In fact, I have been obliged to keep some constantly in bed to prevent their dying of starvation. A fact that helps to show the feasibility of the anæmic theory is that brandy and other stimulants give considerable relief for a time, which would not be the case if cerebral congestion had to do with sea sickness. The explanation of how sea sickness continues so persistently in some, is that the sickness weakens the heart's action, and this keeps up the cerebral anæmia, and that in turn again produces the sickness; so that prolonged sea sickness is due to a circuit of causes, the one producing the other—the visional irritation, cerebral anæmia, sickness, weak heart's action."

Mr. Naylor adds that amyl nitrite usually does good in sea sickness, if used at once, because, being an anti-spasmodic, it relieves the spasm of the cerebral vessels, and thus the brain is refilled with blood. But if it fails, then the persistent sickness, by its effect on the contractions of the heart, prevents the brain from getting a sufficient supply of blood, and thus the brain becomes anæmic, not from a spasm of the capillaries, but from an insufficient power of the heart. It is at this stage that alcoholic stimulants in small doses, frequently repeated, give great relief.

Clearing Harbors of Torpedoes, Etc.

A trial has lately been made on board the Bloodhound, gunboat, at Portsmouth, Eng., of a new means which has been suggested by Captain Arthur, while in command of the Vernon, for clearing harbors of sunken mines and fixed torpedoes. At present the method adopted is to destroy the engines by countermining or by the hazardous process of "creeping." This is effected by boats being sent out to grapple for the cable connections, and then serving them by small charges of gun cotton. This mode, however, is very slow. The new method of opening a free channel for the passage of ships, as tried in the Bloodhound, consists in running out a couple of booms, 30 feet in length, from the bows of the ship. Across the submerged ends is fixed a horizontal beam, 38 feet in length, having a zigzag arrangement of iron rods in the form of a W; the idea being that the open space of each V of the series, as it is pushed through the water, will inclose the torpedo fastenings or connections, and lead them to the point at the bottom, which is fitted with a scissor contrivance, the blades of which are worked by levers in connection with the capstan on board. The beam searcher has a sweep of 50 feet, and the mechanism is capable of cutting through the strongest electric cable. A net, which is supported from the whiskers of the bowsprit, receives the liberated torpedo, and prevents it exploding against the operating craft. The trial proved a great success.

Comparative Strength of Explosives.

The report of the United States Board of Army Engineers, just published, presents the following interesting table as the result of two years' thorough trial of the relative efficiency of the various modern explosives, taking ordinary dynamite as the standard:

Dynamite, No. 1	100
Gun cotton	87
Dualin	111
Rendrock	94
Dynamite, No. 2	83
Vulcan powder	82
Mica powder	83
Nitro-glycerine	81
Hercules powder, No. 1	106
Hercules powder, No. 2	83

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

NEW BOOKS AND PUBLICATIONS.

DISTRIBUTION OF HEAT IN THE SPECTRA OF VARIOUS SOURCES OF RADIATION. By W. W. Jacques, Ph.D. Cambridge: John Wilson & Son.

Contains a review of the more important experiments that have been made in connection with the distribution of heat in the sun's spectrum, with an account of Dr. Jacques' own experiments.

WONDERS OF THE FLORA. By H. Acosta Kresken. Dayton, Ohio: P. A. Kemper. 12mo, cloth, price $1.50.

As its title does not indicate, this is a singularly good little treatise on the art of preserving flowers with their natural colors; to which is added a number of chapters on ornamental grasses and mosses and their uses, directions for collecting and preserving butterflies and other insects, the art of making wax flowers and fruits, and kindred subjects. Mr. Kresken has worked up his subject with no little patience and enthusiasm, and gives his readers the benefit of many years of experience in this department of household decoration. His exhibitions of preserved flowers at the Cincinnati Exhibition and elsewhere have been much admired, and have won him many medals. The book is prettily printed and bound.

AROUND THE WORLD WITH GENERAL GRANT. By John Russell Young. New York: American News Company. Parts 3, 4, and 5. Price 50 cents each.

These three numbers of Mr. Young's splendid record of the travels of General Grant, cover the experience of the party in Paris, on the Mediterranean, in the chief Italian cities, at Malta, Cairo, and up the Nile. The promise of the early numbers is well sustained both in the narrative and in the numerous and exceptionally fine illustrations.

HYGIENE AND PUBLIC HEALTH. Edited by Albert H. Buck, M.D. 2 vols. 8vo, pp. 791 and 675. New York: William Wood & Co.

The most important cyclopedia of individual and public sanitation ever published. The several papers, each a treatise in itself, have been written by American physicians and scientific investigators of established reputation, with special reference to the climates, conditions of soil, habitations, modes of life and laws of the United States. The introductory chapter, by Dr. John S. Billings, U. S. A., sets forth in some seventy pages the scope and importance of the subject, the causes of disease, and the jurisprudence of hygiene. Then follow: Infant Hygiene, by Dr. A. Jacobi; Food and Drink, by Dr. James Tyson; Drinking Water and Public Water Supplies, by Professor William Ripley Nichols; Physical Exercise, by Dr. A. Brayton Ball; The Care of the Person, by Dr. Arthur Van Harlingen; Soil and Water, by Dr. Wm. H. Ford; The Atmosphere, by Dr. D. F. Lincoln; General Principles of Hospital Construction, by Dr. Francis H. Brown; Hygiene of Occupation, by Dr. Roger S. Tracy; Hygiene of Camps, by Surgeon Charles Smart, U. S. A.; Hygiene of the Naval and Merchant Marine, by Dr. Thos. J. Turner, Medical Director, U. S. Navy; Hygiene of Coal Mines, by Henry C. Sheafer, of the *Miner's Journal*; The Hygiene of Metal Mines, by R. W. Raymond, Ph.D.; Infant Mortality and Vital Statistics, by Dr. Thos. B. Curtis; Public Nuisances, by Dr. R. S. Tracy; Adulteration of Food, by Stephen P. Sharples, S. B.; Sea Board Quarantine, by Dr. S. Oakley Vanderpoel; Inland Quarantine, by Dr. S. S. Herrick; Small Pox and other Contagious Diseases, by Dr. Allan McLane Hamilton and Dr. Bache McE. Emmett; The Hygiene of Syphilis, by Dr. F. R. Sturgis; Disinfectants, by Elwyn Waller, Ph.D.; Village Sanitary Associations, by Dr. R. S. Tracy; School Hygiene, by Dr. D. F. Lincoln. The writers will be recognized as among the best known physicians, medical and surgical professors, sanitary inspectors, and health officers of the country. For the medical profession and for public health officers and inspectors the work must prove of the highest value. If it could have a proper popular circulation, the benefit would be inestimable. It is too much to hope, however, that the public will take anything like a sufficient interest in matters of such vital importance as to secure to the work anything like the general reading it should have. It should have a place certainly in every public library.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) F. B. G. writes: 1. I send per mail a sample of rock for examination. It is unlike any of the other rocks and ledges about here; we use it for cutting glass. It makes a good polishing powder. A. It is quartz rock. 2. Is there anything used in refining kerosene oil that would cause it to be unsafe to take as a medicine? A. Usually, no. We cannot recommend such a "medicine," however.

(2) "Engineer" asks: What is the Great Eastern steamship doing at present? Have you given any news about this ship in any previous number of your paper, as I believe it was reported lately in the London *Times* she was being newly fitted up for some new trade? A. We last heard that she was being fitted up for the cattle trade between Texas and Great Britain.

(3) T. H. J. asks by what process the two lenses (forming an achromatic lens) can be separated, the balsam cement (uniting the two) having become hardened by age. A. Heat them in hot water.

(4) R. B. N. asks: What is torsion strength in horse power of 2 inch wrought iron turned shafting, ten, forty, and fifty feet long, driving pulley being at end of shaft; and what breaking strain at ten feet? A. It depends upon the speed of the shaft. You must have the bearings close enough together to prevent a serious spring of the shaft from the strain of the belts.

(5) W. C. asks: 1. How many ounces of pure gold are obtained from one ton of high class California quartz? A. There is a wide difference in the yields of different mines—from 30 cents per yard (hydraulic gravel) to $1,000 per ton (quartz lode); from $6 to $70 would perhaps comprehend the average variation of those quartz mines at present profitably worked. 2. How much is one ounce of gold worth? A. Pure gold is worth $20.67 per ounce.

(6) J. C. C. writes: 1. I have a boat 18 feet long by 4 feet broad; she also has very fine lines. I have a link motion engine 2x2. Is the engine large enough for the boat? A. No. 2. Would you advise me to use one of Herreshoff's coil boilers, or a common one? A. A common one. 3. How big a wheel should I use, and what speed would she make? A. 15 or 16 inches diameter. Probably about 4 miles per hour, if you have plenty of boiler.

(7) E. B. asks: How do the makers of carved toy work in Switzerland and Germany learn their skill, acquire their ability in imitating forms of men and animals?—for, I take it, this ability of theirs is not learned in any school. A. The skill of the Swiss and German wood carvers has been developed very largely by the instruction in this art furnished by special schools, established for the purpose in all the wood carving districts.

(8) W. T. A. writes: When a steam engine is working does the steam exert the same force on the cylinder head as on the piston? A. Yes.

(9) E. C. M. suggests the following method of binding the numbers of the SCIENTIFIC AMERICAN into compact volumes: Procure two small planks, slightly longer than the paper and, say, 1¼ inch wide and ¾ inch thick; pine will do. Having nicely arranged the papers, place the volume between these planks, and tie a strong double cord loosely around them. This cord is then drawn taut by inserting two uprights, say 2½ inches high, and is still further tightened by twisting by means of the short stick, A, as in the old fashioned buck saw. In this way the papers are firmly compressed.

Fig. 1

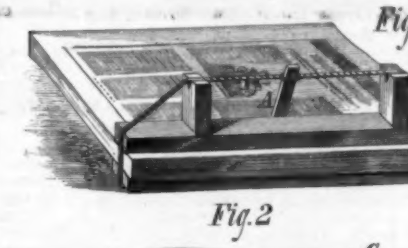
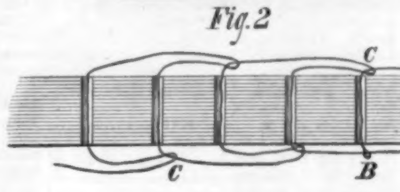


Fig. 2



Then with a 1-12 inch twist drill (using, preferably, a spiral drill tool) pierce from 13 to 14 holes along the edge of the volume, taking care that the former is supported from below at the point of drilling Finally pass a strong waxed cord through the holes, making a slip knot at B, and continuing in a sort of lock stitch way as indicated by the diagram, always drawing the cord as tight as possible. The head of a stout pin will do to pass the cords at the points, C. Fasten the end of the cord, and all that then remains to be done is to remove the planks.

(10) J. H. W. asks: Which has the most power, a cylinder with 20 inch bore and 20 inch stroke, or two cylinders 10 inch bore and 20 inch stroke, using the same steam pressure in both cases? A. If they make the same number of revolutions, the 20 inch cylinder has double the power of two 10 inch.

(11) C. H. asks for a receipt for keeping the bright surface on polished steel instruments, such as pocket knives, razors, drawing and surgical instruments; and how to remove the tarnish. A. In finishing a film of oil remains adhering to the steel, which, under ordinary circumstances, preserves the luster. Clean them frequently, and especially after handling, with well dried chamois leather.

(12) W. M. asks how to remove wool from the skin, without clipping. I have a large quantity and find it very tedious to clip, and I think there is a process to remove it without soiling the wool. A. Short wool is removed from skins by a process called "liming," in which the skins are soaked in milk of lime until the tissues are sufficiently softened to admit of removing the wool readily by hand pulling. Due care must be observed to avoid injuring the wool.

(13) F. C. writes: On Thursday last we had a collision on the Camden and Atlantic Narrow Gauge Railroad, in which five lives were lost on the passenger train, the other colliding train being freight. Now, accounts state that the engineer of the passenger train, seeing that it was impossible to avoid a collision, opened the throttle valve of his engine to give all the impetus possible to his train, with the object of trying to knock the freight train off the track, when by so doing it would prevent the passenger cars from telescoping and save the lives of many passengers. Was this mode of proceeding correct? A. It is stated as the result of experience, by old railroad engineers, that in all cases of apprehended collision, if the speed of the train cannot be effectually checked, and a collision be unavoidable, the safest course is to get all the speed possible, as the slowest train invariably receives the most damage.

(14) J. A. S. asks: 1. What would be the best and cheapest piping for conveying strong salt water, say 5 or 6 inch stream, for a distance of 5 or 6 miles? A. Wood tubing, also enameled iron conduits, are in practical use for such purposes, and have, we believe, proved most economical. 2. Is there a work published giving the different systems of water works, if so, where can it be had, and what would be the cost? A. There are a number of good works on this subject. Address the book dealers who advertise in these columns for catalogues.

(15) D. S. asks for a method of removing mildew from sailcloth. A. Hypochlorite of alumina is said to be one of the best remedies. Moisten with water, rub well into the cloth, moisten again with dilute sulphuric acid (1 to 20), and, after half an hour, rinse thoroughly in soft water and then in water containing about an ounce to the gallon of sulphite or hyposulphite of soda. A stiff brush may be advantageously employed in applying the hypochlorite.

(16) J. H. N. asks: What preparation is used in dyeing duck deadgrass color? A. Boil the goods in a bath of 2 lb. ferrocyanide (yellow prussiate) of potassa, wring out half dry, and then boil in a solution of ¼ lb. sulphate of copper in 10 gallons water. Use stronger copper for a stronger color.

(17) A. H. M. asks: 1. What are the proportions of the popular shoe dressing for ladies and children's shoes? It is composed of gum shellac, borax, extract logwood, bichromate of potash, and ammonia, but I cannot get the proportions to make it. A. See p. 171 (22), current volume of SCIENTIFIC AMERICAN. 2. I want to make one of those phosphorescent or illuminated faces for clocks. What shall I use and how shall I use it, and is it permanent? A. The substance employed for this purpose is a sulphide of calcium mixed with a a resinous varnish. 3. I dissolved some India rubber in turpentine and benzine and applied it to cheap muslin and calico; but it will not fill the cloth so as to make it waterproof. What shall I mix with it to make it fill the cloth to be elastic and flexible? What I applied was as thick as honey. A. Moisten the cloth thoroughly, before applying the varnish, with benzol. When the coating has partially dried pass the cloth between heavily weighted soapstone rolls.

(18) D. M. C. asks how to make a good modeling wax, such as mould makers use. A. Melt 20 ounces of best white wax, and while it is cooling mix with it 1 ounce flake white. 2. I have been making a brass mould for casting white metal rings; the castings are about 2 inches in diameter, and they do not fill the mould. A. Provide plenty of small air vents, smoke your mould occasionally, and pour your metal into the mould through a deep gate or channel. If you do not succeed well with the metallic mould, try plaster of Paris, following directions given in SUPPLEMENT, No. 17.

(19) W. C. writes: In your issue of July 12, Mr. Cobb speaks of the good results he obtains from the use of refined petroleum in his boilers. Will you please inform me in your Answers to Correspondents, what he means by refined petroleum, or to what grade of oils in our markets this would apply? The water we are compelled to use here is about the worst in the world, being mostly from wells sunk in the sand. It seems to be charged with dissolved shells, etc., in addition to the usual salts of sea water, and forms a most obstinate scale very rapidly. I have tried a number of compounds, which were all highly recommended, but none of them were successful, even to the extent of modifying the evil. A. Petroleum which has been freed from earthy impurities and subjected to partial distillation in order to remove the lighter or more volatile hydrocarbons—such as petroleum ether, gasoline, etc., is usually denominated refined petroleum. Under the circumstances a feed water heater properly arranged would probably remove much of the incrustation-forming matters.

(20) F. L. asks (1) for a receipt to color iron castings black or brown. A. Mix chloride of antimony with warm olive oil to form a cream, add a few drops of nitric acid, and apply to the warm clean iron. Or apply the following preparation. Sulphate of copper, 2 oz.; chloride of iron tincture, 1 oz.; nitric acid and spirits of nitre, each ½ oz.; spirits of wine, 1 oz.; water, 40 oz. A strong warm aqueous solution of pyrogallic acid stains iron black. 2 To bronze castings. To make castings with green and bronze stripes. I would like a cheap made up preparation of chemicals, and at the same time one that would look well. A. Shellac, 4 oz.; benzoin, ½ oz.; methylic spirit, 1 pint; dissolve and strain through a fine cloth. To this add a sufficient quantity of bronze green, finely ground. Lampblack, red or yellow ocher may be added to temper the shade. Thin with methylic spirit, and apply with a brush. This work is usually given a thin coating of the clear varnish and touched up with gold powder. 3. A receipt for tinning gray iron castings, and the method of doing the work. A. Clean the castings by pickling in dilute sulphuric acid (1 to 20 of water) and scouring with sand if necessary. Then boil them in a concentrated aqueous solution of stannate of soda, with a quantity of granulated tin. 4. How to copper iron castings. A. Clean the iron as above and tumble it for a few minutes in sawdust moistened with a solution of one lb. sulphate of copper in two gallons of water made slightly acid with oil of vitriol. Wash immediately in hot water.

(21) F. H. S. asks: 1. What is the best form of a simple battery, and how many cells would be required for nickel and silver plating? A. You can use

several cells of an ordinary Smee battery, with carbon negative plate. The zinc surface exposed in the battery should about equal the surface of the work in the plating bath. A tension of two such cells will be found sufficient for ordinary work. 2. How are the solutions for gold and silver plating made, and what are the proportions for 1 gallon of each of the solutions? A. The whitening bath consists of a solution of 1 lb. potassium cyanide and ½ oz. of silver cyanide or chloride to the gallon of water (soft); the plating bath of 1 lb. potassium cyanide and 1 oz. silver cyanide or chloride per gallon of water. For gold plating see p. 2540, No. 160, SCIENTIFIC AMERICAN SUPPLEMENT. 3. How is the quantity of silver deposited determined? What is used in the silver solution to plate bright, and how used? A. Weigh the work before and after plating. This is seldom resorted to, however, the time of exposure in the bath being a sufficient index for practical purposes. Carbon disulphide is sometimes added to the bath with the intent of securing a bright deposit, but as a rule, electroplaters prefer to dispense with any such addition to their baths. 4. How are the plated surfaces polished? A. Usually by burnishing with tools of steel or bloodstone, or by buffing with rouge and whiting.

(22) A. A. & S. ask: How much more water is there in every cubic inch in a pipe at 50 lb. pressure, than when there is no pressure? A. The difference is inappreciable. Water is practically incompressible.

(23) H. B. & S. ask: If the inside of a house has been painted long enough to have been dry and the paint yet sticks, what will prevent the paint from sticking? A. Try a small quantity of linseed oil with plenty of drier, and thinned down considerably with turpentine. You should try the experiment on a small scale at first.

(24) C. T. asks: Which would support the greater weight, a pillar of solid iron, 4 inches in diameter, or one of same diameter of hollow iron, and about what would be the difference in strength? A. One of solid iron. The difference would depend upon the thickness of the hollow pillar.

(25) T. T. P. writes: Our village is watered by a spring about six hundred yards away, at an elevation of some 15 or 20 degrees. The water is conveyed to the town through an inch lead pipe, having only one outlet. I put a stop cock hydrant in the pipe, about one hundred and fifty yards from its outlet. I proceeded as follows: After inserting my faucet or stop cock perpendicularly, I made a short bend upward in the pipe just below, the bend being elevated about ten inches above the cock. The water only made a gurgling noise and passed on by the stop cock without flowing out. What is the difficulty, and how can I make it work? A. You put in the stop cock at right angles to the current in the pipe; the current carries the water past the opening without being diverted from its course. If you insert an enlargement in the main pipe, and divert the water to the stop cock with an easy angle, you will probably succeed.

(26) "Novice" writes: I wish to move a shaft which is now geared to another as follows: The distance between each shaft centers is 8½ inches, and on one shaft there is a 4 inch diameter gear, and on the other a 13¾ inch gear. I wish to move the shaft with the 13¾ inch gear 3¾ inches further away from the shaft with the 4 inch gear, and retain the present speed of both; what size gear shall I put on each shaft? A. Wheel, 19·21 inch diameter; pinion, 5·58 inch diameter.

(27) W. C. T. asks: 1. Can I place one end of a 2 inch iron pipe in the fire and force air through 100 feet with a fan and have it come out hot at the end from the fire? A. Yes. 2. If the air is forced through very rapid will the speed cool it before it gets through? A. It will probably part with some of the heat, though if sent through the pipe at a high velocity, the loss will be very slight.

(28) P. M. writes: 1. In testing a steam boiler with cold water pressure, if the inspectors apply 120 lb. pressure, how much steam can the boiler carry with safety? A. By inspectors' rules, 80 lb. 2. Which can you get the greatest pressure with, cold water or steam? A. With cold water, having proper appliances. 3. Why is water used in preference to steam? A. If the boiler gives way under the test, the water is not so dangerous or destructive as steam. 4. In your article on the horse power of the steam engine, where do you get the 33,000 that you divide with? A. 33,000 lb. lifted one foot high per minute, is the unit of horse power. It represents the power of one horse.

(29) J. G. B. writes: There is an engine in this place, 8x12 cylinder, which makes 150 revolutions per minute, uses 70 lb. steam on gauge; sold by maker for 15 horse power. By rule in SCIENTIFIC, it is 50 horse power. What is the matter? One fifth off for friction, and it would be 40 horse power. A. Your engine was sold you as a 15 horse power nominal. It is a poor engine that cannot in use give out double its nominal power, and frequently it is 3 to 5 times the nominal power. 2. Will you work out your rule in all its details, so that it can be comprehended by all, with 2 sums, say one engine, 8x12, 150 revolutions, 70 lb. steam, and one 10x20, same revolutions and steam? A. You say 70 lb. steam: this is the pressure in the boiler, but what is it in the cylinder? Boiler pressure does you no good, except you get it in the cylinder. Your 8 inch cylinder, by 12 inch stroke, with 70 lb. steam in cylinder, 150 revolutions is: Area of 8 inches = 50 inches, and 150 revolutions = 300 feet per minute, then $\frac{50\times70\times300}{33{,}000}=13{\cdot}8$ horse power; deduct 20 per cent for friction and losses, 31·8 − 6·3 = 25·5 horse power. Then for 10 inch cylinder, 20 inch stroke, 70 lb. steam, and 150 revolutions = 550 feet per minute, $\frac{78{\cdot}5\times70\times500}{33{,}000}=83$ horse power, less 20 per cent = 83 − 16·6 = 66·4 horse power.

(30) J. B. H. asks (1) how to Babbitt a brass box of an engine that is worn well down and thumping. A. Drill shallow holes in the box, tin the surface, and then cast in the Babbitt metal. 2. What will stop a boiler from foaming? A. We cannot inform you without knowing the cause. Sometimes throwing a little oil in by the feed pump will check it temporarily. 3. How to find out the pressure of steam in the cylinder. A. By using an indicator. 4. To find out how much water the pump of an engine is throwing. A. If the pump is throwing full, estimate its contents; otherwise deliver the water into a tank a certain number of strokes, and measure the water in the tank. 5. How to find out the horse power of an engine. A. See reply to J. G. B., on this page.

(31) G. B. M. writes: I wish to transmit five horse power the distance of one mile. Can it be done with a line of shafting; and if so what size iron? A. The use of shafting for your purpose would be very expensive and unsatisfactory; the torsional spring or elasticity would be so great that the speed given off would be very irregular. Wire rope transmission would be cheaper and far better.

(32) W. H. M. S writes: Please give me a rule to determine the horse power of an engine. Suppose a locomotive engine with a driving wheel 5 feet diameter, length of stroke 4 feet, cylinder 16 inches diameter, and a pressure in the boiler of 125 lb. to the square inch: what is the horse power? A. See reply to J. G. B., on this page.

(33) J. F. asks for the best paint or other cheap, available means of protecting a wrought iron post from rust in damp ground. A. Use a good asphaltum varnish thickened with anhydrous iron oxide or burnt ocher.

(34) F. S. W. asks: How can I make lard hard, yet run into an oil when a gentle heat is applied to it? I have tried wax, but it leaves small hard lumps when cold. A. Try paraffine wax.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

C. W. C.—Argentiferous copper glance. This ore will probably prove well worth working.—F. K.—They are crystals of chrome alum. The carbon had probably been employed in a bichromate of potash battery.—T. A. H.—It is a hydrocarbon closely resembling hatchettite, probably of natural origin. A larger sample would be desirable to properly classify it.—W. C.—Neither of your samples contains silver. No. 1 is a shale, and No. 2 a ferruginous sandstone.—J. W. W.—1. A variety of amphibole. 2. Quartz and argentiferous galena, of some value.—W. R. T.—It is *simply lunator.*

COMMUNICATIONS RECEIVED.

On Aids to Motive Power of Vessels. By E. R.
On Astronomical Phenomenon. By J. H.
How to Forecast the Weather. By G. R. C.
On the Ground Element. By E. Z.

[OFFICIAL.]

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Compressed yeast, H. H. Shufeldt & Co. 7,621
Condensed milk, Orange County Milk Association 7,619
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